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PROCESSES CONTROLLING NUTRIENT TRANSPORT IN THE SOUTHEASTERN EVERGLADES WETLANDS, FLORIDA, USA

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Oceanography and Coastal Sciences

by
Martha Sutula
B.S. Purdue University, 1987
MPH Tulane University, 1994
May, 1999

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To my best friend and husband, Juan Carlos Josse

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ABSTRACT

The purpose of this dissertation was to investigate the processes that control material transport in the Southeastern (SE) Everglades and exchange with Florida Bay. Specifically, the objectives were to: 1. determine the factors controlling the spatio-temporal trends in material concentration and exchange; 2. estimate the annual nutrient and carbon export from the SE Everglades; and 3. determine the relative importance of surface water, atmospheric deposition, groundwater, and intrasystem cycling as sources and losses of nutrients to the watershed. Patterns in material exchange were observed for 2.5 years in three of five major creeks draining the SE Everglades. Statistical methods were used to derive annual carbon (C), nitrogen (N), and phosphorus (P) export to Florida Bay. Finally, water and nutrient budgets were calculated for the watershed. The seasonal pulse of freshwater and the lower input in the western watershed relative to the east explained the major spatio-temporal patterns in material exchange. Approximately 99% of exports to Florida Bay occurred during the rainy season. Higher hydraulic residence time and the advection of P-rich Gulf of Mexico waters to the western Bay resulted in higher nutrient concentrations and a lower TN:TP ratio in the western-most creek relative to the eastern creeks. The SE Everglades annually exported 7.1 g C m^{-2}, 0.46 g N m^{-2}, and 0.007 g P m^{-2} to Florida Bay. The low P flux relative to other estuarine systems reflects the efficiency of Everglades ecosystem in conserving P. Atmospheric deposition was the dominant P source to the watershed. Surface water was the major N source during the wet season, but annually equaled atmospheric N deposition. Annually 20 mg P m^{-2} and 590 mg N m^{-2} were imported into the watershed from hydrologic sources (surface water, groundwater, atmospheric deposition). Annual P import roughly equaled sediment P

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burial (33-71 mg m^{-2}), while sediment N burial (1890-4071 mg m^{-2}) exceeded hydrologic import. This budget deficit may be balanced by N fixation or may be due to underestimation of groundwater flux into the watershed. Further research is needed on the contribution of groundwater and N fixation to the nutrient budget of the SE Everglades wetlands.

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CHAPTER 1

PROCESSES CONTROLLING MATERIAL TRANSPORT ACROSS THE BOUNDARIES OF THE SOUTHEASTERN EVERGLADES WETLANDS

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1.1 INTRODUCTION

Processes controlling material exchanges at the boundaries of coastal wetland ecosystems are a major focus of estuarine research (Childers et al., 1999). Such exchanges are a source of materials for new production within the ecosystem, and a subsidy of energy and materials for adjacent ecosystems (Odum, 1971). Four of the major boundaries in coastal wetlands include: 1) the transition zone between wetland and coastal waters, 2) air-water boundary, 3) sediment-water boundary, and 5) boundaries with the upper watershed. Quantifying of the relative magnitude and direction of material fluxes across these boundaries often clarifies the major controls on productivity, organic matter accumulation, nutrient cycling and transport within the ecosystem (Kemp et al., 1982). Primary production is often accelerated at these boundaries, because of the input of new sources of organic matter and nutrients.

Fluxes at the interfaces of coastal wetland ecosystems are controlled by specific geomorphologic, hydrologic and physical-forcing regimes, otherwise referred to as the energy signature of the ecosystem (Twilley, 1995). Forcing functions that comprise the energy signature of a system vary both temporally and spatially, and therefore are a major source of variability in the patterns of material concentration and exchange. The energy signature can influence not only the magnitude and direction of material exchange, but also the predominant forms (dissolved or particulate, organic or inorganic) of these materials (Nixon, 1980; Lee, 1995; Twilley, 1995).

The energy signature of the Florida Bay-Everglades estuarine system is unique among North American estuaries because of its carbonate sedimentary environment, restricted tidal regime, and sub-tropical climate (Davis, 1940; Lugo and Snedaker, 1974;

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Light and Dineen, 1994). Phosphorus is the limiting macronutrient in both Florida Bay and the southern Everglades, due to the strong affinity that carbonate minerals have for phosphorus (de Kanel and Morse, 1978). Phosphorus availability and distribution strongly control productivity of seagrasses (Fourqurean et al., 1992a; Powell et al., 1989), phytoplankton (Fourqurean et al., 1993), and mangrove forests (Koch, 1996). It is hypothesized that the Gulf of Mexico (GOM), which forms the western margin of Florida Bay, is the major source of phosphorus to the Florida Bay estuary and the wetlands on the western Florida panhandle (Fourqurean et al., 1993; Rudnick et al., in press; Chen and Twilley, in press). This hypothesis is consistent with observed gradient of C:P ratios in the seagrass biomass from high in the eastern Bay to low in the western Bay (Fourqurean et al., 1993), and a gradient of increasing sediment P concentration seawards in Shark River Slough (Chen and Twilley, in press).

The purpose of this dissertation is to investigate the major processes controlling the input and transport of nutrients in the Southeastern (SE) Everglades, and exchange with Florida Bay. Specifically, the SE Everglades is defined as the area encompassing Taylor Slough and the wetlands south of the C-111 canal (hereto referred to as the Taylor Slough/C-111 basin). In this work, I first present a review of the potential factors controlling nutrient transport and exchange at the boundaries of the Taylor Slough/C-111 basin, and discuss the objectives of this dissertation (this chapter). Next, I present an analysis of the processes responsible for the spatio-temporal patterns in material concentration in the salinity transition zone between the Taylor Slough/C-111 basin and Florida Bay (Chapter 2). In Chapter 3, I explore how hydrology controls the spatio-temporal patterns in material flux between the Taylor Slough/C-111 basin and Florida

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Bay, and estimate the annual flux of carbon (C), nitrogen (N), and phosphorus (P) from these wetlands. Finally I present the seasonal and annual water and nutrient budgets for the Taylor Slough/C-111 basin wetlands (Chapter 4). I use these budgets to understand the relative importance of hydrologic nutrient inputs (atmospheric deposition, surface and groundwater) versus biological sources and sinks of nutrients within the wetland.

1.2 PROCESSES CONTROLLING MATERIAL EXCHANGES AND TRANSPORT IN THE SOUTHEASTERN EVERGLADES WETLANDS

In this review, I synthesize the current understanding of the importance of and factors controlling nutrient exchange at four major interfaces of the Taylor Slough/C-111 basin wetlands:

- Taylor Slough/C-111 basin wetlands-Florida Bay boundary
- Air-water boundary
- Groundwater-wetland sediment or surface water boundary
- Taylor Slough/C-111 basin-upper watershed boundary

1.2.1 Material Exchange at the Wetland-Coastal Water Interface

Quantification of material flux at the wetland-coastal waters interface has been the focus of much research during the last three decades, because of the potential importance of wetland outwelling as an energy subsidy to coastal oceans (Childers et al., 1999; Nixon, 1980; Odum, 1984). Much of our understanding of the quality and quantity of exchange between these subsystems has been derived from mass balance studies conducted in temperate, salt marsh-dominated estuaries. The majority of studies yielding direct measurements of material exchange have been carried out in the tidally dominated estuaries of the eastern U.S. (Dame et al., 1986; Settlemyre and Gardner, 1977; Valiela et

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al., 1978; Woodwell et al., 1977, and others). Several studies have also been conducted in the low-tidal energy estuaries of the GOM, where material exchanges can be greatly influenced by wind-driven or other non-local forcing (Armstrong and Hinson, 1978; Childers et al., 1990; Leonard et al., 1995; Stern et al., 1991; Stern et al., 1986). There are even fewer examples of material exchange studies conducted in tropical or sub-tropical environments. Most flux studies conducted in mangrove-dominated estuaries have been in tidally dominated systems with significant inputs of terrigenous-clastic sediments (Boto and Wellington, 1988; Simpson et al., 1997; Woodroffe, 1985). Only two studies have been conducted in tropical or sub-tropical, carbonate sedimentary environment with a restricted tidal regime (Twilley, 1985; Rivera-Monroy et al., 1995). Conclusions on the material transport in sub-tropical coastal wetlands have to a large extent been based on material flux studies which focus on the particulate forms, and with little information on the spatial and temporal variability in the exchange patterns (Lee, 1995).

Material exchanges between wetlands and coastal waters have been difficult to quantify, largely because of the inherent variability of systems which occurs on both temporal and spatial scales (Childers et al., 1993; Smith, 1979). In macro-tidal wetlands, tidal forcing is a dominant determinant of net flux (Kjerfve and McNellar, 1980), and flux studies in such systems have placed an emphasis on monitoring temporal variation in flux over several tidal cycles (e.g. Alongi et al., 1989; Chrzanowski et al., 1983; Dame et al., 1991; Jordan et al., 1986; Woodroffe, 1985, and others). However, significant exchanges driven by non-local forcing can occur with periods greater than that of the tidal cycle (Kjerfve et al., 1978). This is especially true for micro-tidal wetlands. Several studies have shown significant variability in material flux during non-local forcing events

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such as cold fronts and tropical storms (on the order of 10-18 days-Kjerfve et al., 1978; Leonard et al., 1995) and during different seasons (Childers and Day, 1990a; Childers and Day, 1990b; Stern et al., 1991). Spatial variations in hydrology and material concentration compound the complexity of measuring material exchange in coastal wetlands (Childers et al., 1993). These gradients, arising from differences in factors such as geomorphology, freshwater input, and proximity to coastal ocean, can result in variation in the magnitude and direction of material exchange between estuarine sub-basins and the greater estuary (Childers et al., 1993; Dame and Gardner, 1993).

Material exchange between the SE Everglades wetlands and Florida Bay is poorly understood. Water flows through the Everglades in shallow, broad sloughs, and is channelized into creeks only near the coastline (Davis and Ogden, 1994). The seasonal patterns of precipitation and surface water flow in South Florida, along with the importance of wind-driven circulation in Florida Bay (Wang et al., 1994), are likely to play a dominant role in material exchange. While an extensive water quality monitoring program for the Everglades and Florida Bay exists (Boyer et al., 1997), there has been no direct measurement of material flux at the interface of these two systems. Quantifying the material exchange between the SE Everglades and Florida Bay will provide greater understanding of the functional role of these wetlands in controlling material transport across the Everglades-Florida Bay landscape.

1.2.2 Atmospheric Deposition

Atmospheric deposition is an important source of nutrients to oligotrophic ecosystems (Cole et al., 1990; Jassby et al., 1995; Prospero et al., 1996). In the Everglades, there are several factors that point to the importance of atmospheric

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deposition as a source of phosphorus (P). First, Everglades wetlands in general are very shallow with ambient total P levels at or below 10 μg/L (McCormick et al., 1996). Thus, atmospheric deposition of even low levels of P can provide an important subsidy of this limiting nutrient. Second, the climatic conditions of south Florida are ideal for atmospheric deposition of P. During the summertime, high evaporative rates from the Everglades in combination with the convergence of seabreezes and prevailing winds produce daily convective thunderstorms with heavy rainfall that can scavenge P from the atmosphere.

1.2.3 Groundwater-Surface Water Interactions

Groundwater seepage can be an important source of water and nutrients to wetlands. Groundwater inputs are a significant portion of the nitrogen (N) budget of Massachusetts salt marshes (Valiela and Teal, 1979; Valiela et al., 1978). In the southern Everglades, groundwater flow is suspected to play a major role in the hydrologic budget of the wetlands since the porous nature of the limestone bedrock enhances hydraulic conductivity (Fennema et al., 1994). Despite the importance of this component, our understanding of wetland-groundwater interactions and their contribution to the nutrient budgets of the Everglades and the adjacent Florida Bay is limited. Based on simulations using the Natural Systems model, Fennema et al. (1994) concluded that the southern Everglades is an important source of groundwater recharge to the Biscayne Aquifer, the main source of water to the lower east coast of Florida. In Florida Bay, estimates based on natural chemical tracers and seepage measurements suggest that groundwater flux may provide as much N and P as surface freshwater sources.

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1.2.4 Material Exchanges Via Surface Freshwater Input to the SE Everglades

The degradation of the southern Everglades and Florida Bay ecosystems has been attributed to a series of anthropogenic changes in hydrology and watershed land use over the past century (Light and Dineen, 1994; Robblee et al., 1991). These include wetland loss, increased nutrient inputs, and construction of a network of over 2200 km of canals for flood control and water supply, which have altered wetland drainage and resulted in the extensive diversion of freshwater to the Atlantic coast by canals. In Taylor Slough, historically the major conduit of freshwater from the SE Everglades to Florida Bay (McIvor et al., 1994), water management alterations have resulted in the reduction in the quantity and duration of freshwater flow (Johnson and Fennema, 1989; McIvor et al., 1994). Currently, surface water inputs to the SE Everglades are anthropogenically controlled via a system of drainage canals and water control structures. These management practices have been implicated in the extended periods of hypersalinity and the decline of seagrass communities in Florida Bay (Fourqurean et al., 1993; McIvor et al., 1994).

The impacts of alterations in freshwater flow are often amplified at the interface between land and the estuary, because of the dependency of estuarine biotic communities on the gradients generated when freshwater flow meets the sea (McIvor et al., 1994). Alteration of freshwater delivery patterns greatly affects material exchanges (Sklar and Browder, 1998). In the Everglades, surface water inputs of nutrients from non-point sources such as agricultural runoff have adversely affected the biotic communities adapted to oligotrophic nutrient levels. Nutrient budgets calculated for a constructed

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freshwater Everglades wetland receiving agricultural runoff showed that surface water accounted for 93-97% of nutrient inputs to the wetland (Moustafa et al., 1995).

Hydrological restoration of the SE Everglades, which began in October 1997, will result in the diversion of water from the L-31W canal to Taylor Slough, and increased overland flow by removal of levees from the C-111 canal (SFWMD, 1990). Thus, the goals of these restoration efforts are to increase freshwater flow to NE Florida Bay and to restore the natural hydrology of the southern Everglades by augmenting flow through Taylor Slough relative to flow in the C-111 basin. However, given the sensitivity of oligotrophic ecosystems such as the SE Everglades and Florida Bay to allochthonous nutrient supply, it is necessary to understand how altering freshwater input affects nutrient mass balances in the SE Everglades, and ultimately, nutrient loading to Florida Bay.

1.3 DISSERTATION AND CHAPTER OBJECTIVES

The purpose of this dissertation was to investigate the major processes controlling the nutrient inputs and transport in the Taylor Slough/C-111 basin, and exchange with Florida Bay. The main objectives were to:

- Determine the processes responsible for major spatio-temporal patterns in material concentration and flux between the Taylor Slough/C-111 basin and Florida Bay;
- Quantify exchange of carbon, nitrogen, and phosphorus at this interface;
- Determine the relative importance of atmospheric deposition, surface water flow, and groundwater exchanges as sources and losses of nutrient to these wetlands, and how these terms compare with internal system loss terms such as sediment burial, denitrification, and nitrogen fixation.

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A summary of the specific objectives and methods used in this research follows. Presentation of research results was organized into three chapters. Each chapter has been prepared as a manuscript to submit for publication. Chapters 2 and 3 will be submitted jointly for publication in a single journal issue.

1.3.1 Spatio-Temporal Variability in Material Exchange Between the SE Everglades Wetlands and Florida Bay: I. Patterns in Material Concentration

The objectives of the work described in Chapter 2 are 1. to quantify the spatio-temporal trends in material concentration in the creeks which drain the Taylor Slough/ C-111 basin; 2. to determine the relative role of physical and biological forcing functions in producing these patterns; and 3. to evaluate the relative importance of a marine (GOM) versus an upland source of P on mangrove wetland surface water concentrations. I hypothesized that 1. freshwater input is the major source of seasonal and spatial variability in material concentration in wetland surface waters, and 2. there is a westward decrease in creek surface water N: P ratio and an increase in phosphorus concentration due to closer proximity to a major P source (GOM). Three of the five major creek systems draining the Taylor Slough/C-111 basin were selected for study. In one creek, TN and TP concentrations were measured daily for two years, and ten 10-day intensive studies were conducted seasonally during a 2.5 year period measuring dissolved inorganic and total nitrogen, phosphorus, carbon, and suspended matter. During one year of the study, four 10-day intensive studies were conducted simultaneously in all three creeks to study the spatial variation in material concentration.

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1.3.2 Spatio-Temporal Variability in Material Exchange Between the SE Everglades Wetlands and Florida Bay: II. Trends in Material Flux and Estimation of Annual Flux of Carbon and Nutrients

The objectives of the research presented in Chapter 3 are to: 1. quantify the spatio-temporal patterns in hydrological and material exchange between the Taylor Slough/C-111 basin and Florida Bay; 2. determine the physical and biological forcing functions responsible for these patterns; 3. estimate the annual flux of nutrients and carbon from the Taylor Slough/C-111 basin to Florida Bay; and 4. assess the potential impact of hydrological restoration efforts of nutrient loading to Florida Bay. I hypothesized that 1. material exchange is controlled by freshwater input and wind rather than tidal forcing, and 2. a decrease in freshwater drainage towards the western boundary of Taylor Slough results in a decrease in material flux from east to west in the watershed. Within the same framework of the study design outlined for Chapter 2, the nutrient, carbon, and suspended sediment flux was calculated from three Taylor Slough/C-111 basin creeks. The annual export of carbon, nitrogen, and phosphorus to Florida Bay was estimated from regression equations predicting flux from water flow.

1.3.3 Use of Hydrologic and Nutrient Budgets to Evaluate the Transport of Phosphorus and Nitrogen in the SE Everglades Wetlands

The objective of Chapter 4 was to calculate the seasonal and annual water and nutrient budgets of the Taylor Slough/C-111 basin. These budgets were used to understand the relative importance of atmospheric deposition versus surface water and groundwater inputs as sources of nutrients to these wetlands. In addition, the magnitude of these source and loss terms versus literature values for sediment N and P burial, N

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fixation, and denitrification in this region were assessed. I hypothesized that in the relatively pristine SE Everglades wetlands, atmospheric deposition is a more important source of P than surface freshwater input. Seasonal inputs and outputs of water, TP and TN from surface water, precipitation, and evapo-transpiration to the Taylor Slough/C-111 basin were calculated for 1.5 years. Groundwater was estimated as the difference between input and output terms.

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CHAPTER 2

SPATIO-TEMPORAL VARIABILITY IN MATERIAL EXCHANGE BETWEEN THE SOUTHEASTERN EVERGLADES WETLANDS AND FLORIDA BAY: I. PATTERNS IN MATERIAL CONCENTRATION

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2.1 INTRODUCTION

Material transport at the land-sea interface is dependent on the "energy signature" of the coastal environment, or the specific geomorphology, hydrology, and physical forcing regime of each system (Twilley, 1995). The energy signature of coastal wetlands can influence not only the magnitude and direction of transport, but the concentration and the predominant form (dissolved or particulate) of the material exchanged (Nixon, 1980; Lee, 1995; Twilley, 1995). The forcing functions which comprise an system's energy signature vary both temporally and spatially within an estuary, and therefore will be major source of variability in the patterns of material concentration. Temporal variability in material concentration of coastal wetlands is well documented, with numerous examples of concentration varying on daily, weekly, seasonal and inter-annual time scales (e.g., Wolaver et al., 1984; Wolaver et al., 1986; Boto and Wellington, 1988; Jordan and Correll, 1991). Variability in material concentration between coastal watersheds has also been examined, but less attention has been paid to examining the gradients that give rise to spatial variability within a system. These gradients, arising from differences in factors such as geomorphology, freshwater input, and proximity to coastal ocean, can result in variation in material concentration among estuarine sub-basins (Childers et al., 1993; Dame and Gardner, 1993).

The energy signature of the Florida Bay-Everglades system is unique among North American estuaries because of its carbonate sedimentary environment, restricted tidal regime, and sub-tropical climate (Davis, 1940; Light and Dineen, 1994; Lugo and Snedaker, 1974). Phosphorus is the limiting macro-nutrient in both Florida Bay and the southern Everglades, due to the strong affinity that carbonate minerals have for

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phosphorus (de Kanel and Morse, 1978). Phosphorus availability and distribution strongly control productivity of seagrasses (Fourqurean et al., 1992a; Powell et al., 1989), phytoplankton (Fourqurean et al., 1993), and mangrove forests (Koch, 1996). It is hypothesized that the Gulf of Mexico (GOM), which forms the western margin of Florida Bay, is the major source of phosphorus to the system (Fourqurean et al., 1992a; Fourqurean et al., 1992b; Rudnick et al., in press). This hypothesis is consistent with observed gradient of C:P ratios in the seagrass biomass from high in the eastern Bay to low in the western Bay (Fourqurean et al., 1992a; Fourqurean et al., 1992b; Rudnick et al., in press). The GOM also acts as a source of phosphorus to estuaries on the west coast of Florida. In Shark River Slough, Chen and Twilley (in press) found a trend of increasing sediment phosphorus seawards along the salinity gradient, indicating a marine (GOM) rather than freshwater source of phosphorus.

During the past decade, the massive die-off of *Thalassia testudinum* and the increased persistence of algal blooms in western Florida Bay have been attributed to a series of anthropogenic changes that have been occurring in the Everglades and Florida Bay over the past century (Robblee et al., 1991). Among these include a diversion of freshwater to the Atlantic coast through a network of over 2200 km of canals, and a subsequent increase in the salinity of Florida Bay. In addition, anthropogenic nutrient inputs from the Gulf of Mexico and the Florida Keys may have increased (Lapointe and Clark, 1992). Hydrological restoration of the SE Everglades, which began in October 1997, will result in the diversion of water from the L-31W canal to Taylor Slough, and increased overland flow by removal of levees from the C-111 canal (Fig. 2.1; SFWMD, 1990). Thus, the goals of these restoration efforts are to increase freshwater flow to

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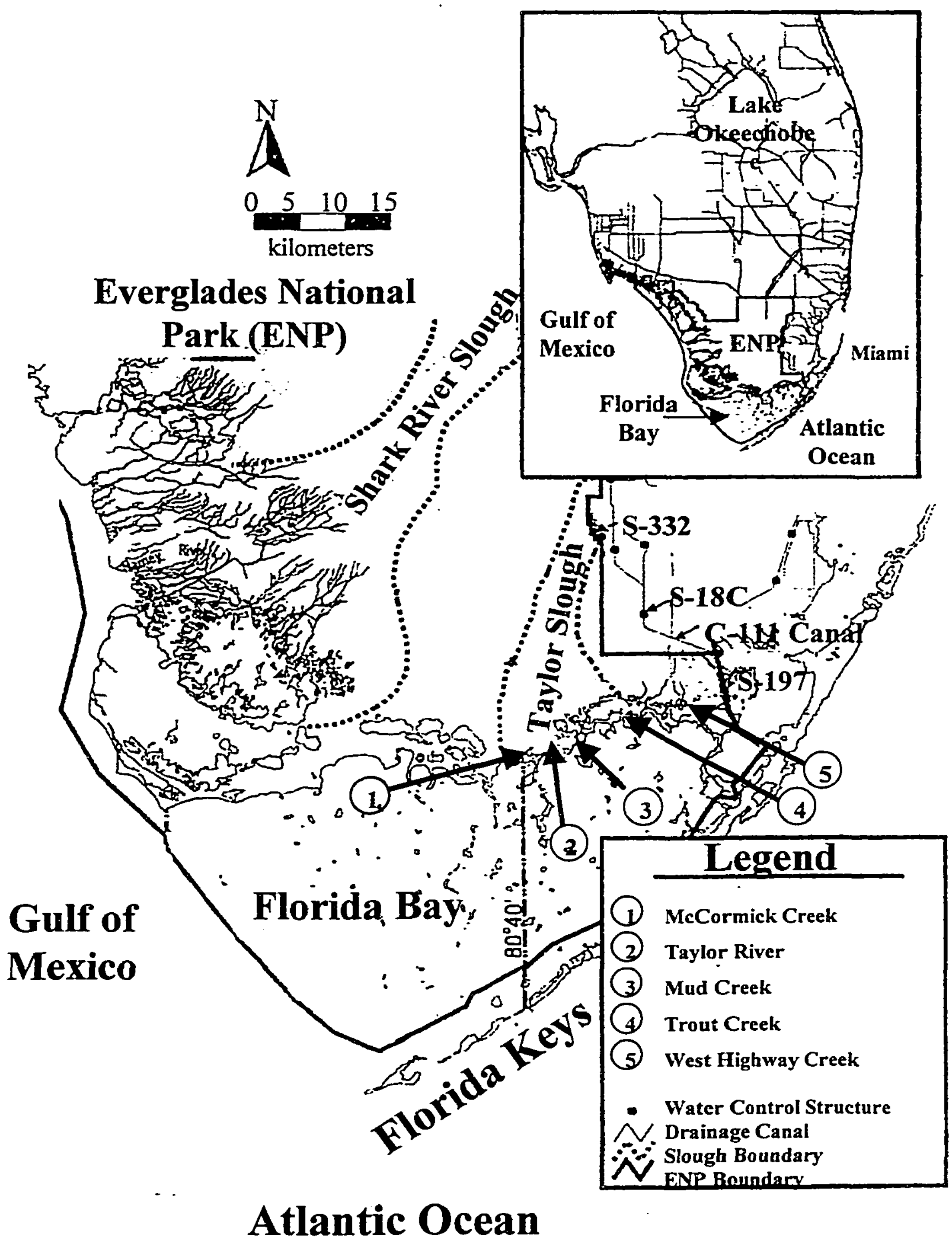

FIGURE 2.1. Map of study area showing locations of creeks relative to southern Everglades and Florida Bay.

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NE Florida Bay and to restore the natural hydrology of the southern Everglades by augmenting flow through Taylor Slough relative to flow in the C-111 basin. However, given the sensitivity of oligotrophic ecosystems such as Florida Bay to allochthonous nutrient supply, it is necessary to understand how altering freshwater input affects nutrient concentrations in the mangrove wetlands of the SE Everglades (hereto referred to as the Taylor Slough/C-111 basin), and ultimately, nutrient loading to Florida Bay.

The overall goal of our research program was to determine the physical and biological processes affecting patterns of material concentration and exchange between the Taylor Slough/C-111 basin and Florida Bay, and how these processes might be affected by increased freshwater flow. Part I of this research, presented in this paper, addresses factors controlling material concentration. Part II (Chapter 3) describes patterns in material flux, quantifies annual flux of organic carbon and nutrients from the SE Everglades, and evaluates the potential impact of increased freshwater flow on nutrient loading to Florida Bay. The objectives of this paper are to 1. quantify the spatio-temporal trends in material concentration in the creeks which drain the Taylor Slough/C-111 basin; 2. determine the relative role of physical and biological forcing functions in producing these patterns; and 3. evaluate the relative importance of a marine (GOM) versus an upland source of P on mangrove wetland surface water concentrations. We hypothesized that 1. freshwater input will be the major source of seasonal and spatial variability in material concentration in wetland surface waters, and 2. we will observe a westward decrease in surface water N: P ratio and an increase in TP concentration due to the advected nutrients from the Gulf of Mexico.

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2.2 METHODS

2.2.1 Study Area

The freshwater and mangrove wetlands of the SE Everglades are located at the tip of the Florida peninsula, and border Florida Bay, a large, shallow, sub-tropical embayment bounded on the south and east by the Florida Keys (Fig. 2.1). The climate of Florida Bay and the Everglades is characterized as sub-tropical savanna with distinct rainy and dry seasons (Hela, 1952), with 75% of the average annual precipitation (range of 890-1140 mm) falling during the rainy season (May - October, Jordan, 1984). While wet season precipitation is produced primarily by daily convection thunderstorms, less frequent tropical storms and hurricanes can also contribute significant amounts of rainfall in short time periods (Chen and Gerber, 1990). During this season, winds in Florida Bay are dominated by a south-easterly sea breeze system. The dry season (December - May) has mild temperatures and low precipitation, with periods of sporadic rainfall and low temperatures associated with the weekly passage of winter cold fronts (primarily November through March, Chen and Gerber, 1990). Cold fronts are characterized by southerly winds during the prefrontal stage, intense squalls with rainfall as the front passes, and strong, cold, northerly winds in the post-frontal stage (Roberts et al. 1989). Tides in Florida Bay are semi-diurnal (Wang et al. 1994). While astronomical tidal amplitudes in the western bay average 30 cm, the mean tide range in the eastern bay is on the order of 5-10 cm due to restricted circulation between the eastern and western basins (Wang et al., 1994). The freshwater wetlands of the southern Everglades are dominated by *Cladium jamaicense*, while dwarf mangroves (primarily *Rhizophora mangle*, *Avicennia germinans, Laguncularia racemosa*, and *Conocarpus erectus*) dominate the

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salinity transition zone. The structure of mangroves follows the patterns described by Davis (1940) and Lugo and Snedaker (1974).

McCormick Creek, Taylor River, Mud Creek, Trout Creek, and West Highway Creeks are the five major creeks that discharge to Florida Bay from SE Everglades watersed. They drain Taylor Slough and the wetlands south of the C-111 canal, a total area of approximately 457 km^2. Where they discharge to the Bay, the creeks cut through an area of relatively high topographical relief called the "Buttonwood Ridge." This ridge restricts the overland flow of water, making the creeks major point source inputs of freshwater to Florida Bay. Since December 1995, the USGS has measured discharge from these creeks into Florida Bay, thus greatly simplifying the task of describing creek hydrology and measuring material exchange. Three of the five creeks, McCormick Creek, Taylor River, and Trout Creek, were sampled because they represent a hypothetical gradient in N:P ratios along an east-west axis. Taylor River, Trout Creek, Mud Creek and West Highway Creek are located in the eastern basin of Florida Bay, an area which has little tidal influence but significant freshwater drainage, and is associated with higher phosphorus limitation (Boyer et al., 1997; Fourqurean et al., 1992a). The two eastern-most creeks, West Highway Creek and Trout Creek, are located the shortest distance to the C-111 canal. McCormick Creek, located on the western margin of Taylor Slough, is likely to have less freshwater influence than the other two creeks. It drains into the western basin of Florida Bay, which has a lower N:P ratio than in the eastern basin (Fourqurean et al., 1992a).

2.2.2 Study Design and Field Methods

The study consisted of several water sampling programs designed to characterize temporal and spatial variability in material concentration in mangrove wetlands of the

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Taylor Slough/C-111 basin. We chose Taylor River to intensively study temporal variability. To capture seasonal and inter-annual variability in material concentration, we measured daily total nitrogen (TN) and phosphorus (TP) concentration for two years (May 1996-1998) at a permanent monitoring station located at the mouth of Taylor River. In addition, ten 10-day studies were conducted at this location approximately every four months (January 1996 -May 1998). These 10-day studies were scheduled to coincide with a seasonal pattern of forcing (Table 2.1), and involved intensive sampling of total and dissolved inorganic nutrients, organic carbon, and suspended matter. The combination of these two sampling designs allowed us to investigate the temporal variation in material concentration over several time scales (daily, weekly, seasonal, and inter-annual). Spatial variation was assessed by conducting four 10-day studies simultaneously in McCormick, Taylor, and Trout Creeks through the one-year period of January - December 1997.

Table 2.1 Summary of Seasonal Forcing Functions in Southern Everglades and Florida Bay

Month	**Temperature**	**Rain**	**Frequency of Cold Fronts or High Wind Events**	**Frequency of Trop. Storms & Hurricanes**
January	Moderate	Low	High	Low
May	High	Low	Medium	Low
August	High	High	Low	High
November	Moderate	High	Medium	Medium

During each 10-day flux study, a Sigma 900 autosampler collected a 1-liter sample every three hours from a single point in the water column. Samples were packed in ice and held in the field for a maximum of 21 h before being transported to the field laboratory for processing. The daily samples, which consisted of a 1-liter daily composite of water drawn four times per day, were collected and stored in the field without ice, and

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processed every three weeks. Continuous discharge and salinity were obtained from USGS acoustic line velocity meters deployed at each of the five creeks (AVM, Laenen, 1985; Laenen and Curtis, 1989; Patino and Ockerman, 1997).

2.2.3 Analytical Methods

Samples were prepared at the ENP Key Largo field station. From each duplicate water sample, a known volume was filtered through a Whatman GF-F 25 mm filter into a 60 ml HDPE bottle, which was frozen and used to determine dissolved inorganic nutrients. For 1996 Taylor River samples, this fraction was also analyzed for dissolved organic carbon (DOC) and dissolved organic nitrogen (DON). The filter was frozen for chlorophyll determination. A 120 ml HDPE bottle was triple-rinsed using unfiltered sample water, filled, then refrigerated for determination of TN, TP, and total organic carbon (TOC). An additional known amount of water was filtered through a Whatman GF-F 25 mm filter, which was frozen for analysis of total suspended solids (TSS) and particulate organic matter (POM). TSS was analyzed using a gravimetric technique described by Banse et al. (1963), while POM was determined following the APHA technique (1992). Chlorophyll was measured by using a dimethyl sulfoxide extraction process (Burnison, 1980; Strickland and Parsons 1972) and fluorometric analysis using a Turner Designs Model 10-AU Fluorometer. Nitrate&nitrite (N&N), nitrite, ammonium, and soluble reactive phosphorus (SRP) were assayed using an Alpkem autoanalyzer (APHA, 1992). DON was digested using the micro-kjeldahl method (APHA, 1992), while TOC and DOC were determined via high temperature catalytic combustion using a Shimadzu 5000 TOC Analyzer (EPA Method #415.1). TN was analyzed using an

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ANTEK nitrogen analyzer (Jones and Frankovitch, in press) and TP was digested as in Solorzano and Sharp (1980).

2.2.4 Sources of Additional Data and Statistical Analyses

Water quality, meteorological and hydrolic data were obtained from the South Florida Water Management District (SFWMD) DBHYDRO database. These include daily discharge and monthly TN and TP concentration from the water control structures which discharge to the Taylor Slough/C-111 basin, vector wind speed from the Joe Bay Weather Station and rainfall from 15 rainfall gauges located through out the study area.

Three types of analyses were used to explore the spatio-temporal trends and the relative importance of physical versus biological forcing on material concentration in each creek. First, to explore spatio-temporal patterns in material concentration, analyses of variance (ANOVA) were used to test for differences in mean constituent concentration by sampling period (Taylor River ten 10-day studies) or by creek and sampling period (four 10-day studies in three creeks; SAS® Proc GLM; SAS, 1989). Where two variables were examined (sampling period and creek), the interaction of the two variables was included in the ANOVA model. Logarithmic or power transformations of the response variables were used to reduce problems associated non-normality and heterogenous variance. Simultaneous confidence intervals for mean constituent concentration computed by season (Taylor River) or creek by season (three creeks) were constructed based on Tukey's comparison-wise error rate of α=0.05. The mean and its respective confidence interval were re-transformed into the original scale for comparison.

Finally, there were two types of analyses used to explore the relationships between the material concentration variables and indicators of physical and biological

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forcing such as creek flow and water temperature. First, factor analysis was used to examine and summarize the covariability among the nine material concentration variables by creek (SAS® Proc Factor; SAS, 1989). High loading scores of a group of variables in one factor suggest a strong negative or positive correlation among these variables. The number of factors necessary for each creek was determined by analyzing amount of variance explained by each factor in a scree plot. Second, partial correlations were computed for each of the material concentration variables with flow and water temperature (SAS® Proc Corr; SAS, 1989). A strong relationship with flow indicates either a consistent concentration trend between water masses advected from the bay versus from upstream or an association with the physical processes driving flow. A strong relationship with water temperature indicates a relationship with biological activity associated with seasonal changes in water temperatures. All statistical analyses were performed using SAS statistical software (SAS, 1989).

2.3 RESULTS

2.3.1 Relationship of Creek Discharge with Surface Freshwater Input Along East-West Gradient

Creek discharge patterns show a distinct seasonal signal associated with meteorological forcing in SE Everglades wetlands. The 2.5 yr record of watershed rainfall, creek discharge and salinity illustrates the strong correlation between watershed precipitation and surface flow in northern Taylor Slough ($R^2 = 0.57$). This freshwater input had a direct effect on creek discharge and salinity regime (Figs. 2.2(a,b)). Low precipitation and surface freshwater inflow during the 1996 and 1997 dry seasons resulted in low creek discharge. The lack of freshwater head and the intrusion of

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baywater into the creek caused salinity to gradually increase to 25-30 ppt in late May-early June (Figs. 2.2(a-b)). Heavy rainfall at the onset of the 1997 rainy season resulted in high discharge rates and a rapid decline of salinity to 0 ppt. Throughout the rainy season, discharge in the four eastern-most creeks was positive with spikes of negative flow associated with strong, south winds or the passage of cold fronts or tropical storms. McCormick discharge during this period declined rapidly in August to low positive values, and was negative during the last two months of the season.

Abnormally high quantities of rainfall and surface water input during the 1998 dry season drastically altered typical dry season salinity and discharge patterns. However, the impact of this increased freshwater input was not uniform among all the creeks (Figs. 2(a-b)). Dry season precipitation within the watershed increased 40% from the previous year. Dry season salinity averaged from a low of 2.5 ppt in Taylor to a high of 4.5 ppt in McCormick, and rose only during the last three weeks of the season. The impact of this increased freshwater input on creek discharge decreased from east to west. A 45% increase in surface flow in northern Taylor Slough resulted in a two to ten-fold increase in discharge in the four eastern-most creeks, while McCormick Creek discharge actually decreased two-fold (Figs. 2.2(a-b)).

The deviation in McCormick's discharge pattern with those of the four other creeks is related to a gradient of decreasing surface water input from east to west in the Taylor Slough/C-111 basin. Discharge from the eastern creeks was more correlated with surface flow in northern Taylor Slough ($R^2 = 0.58 - 0.38$) than in McCormick Creek ($R^2 = 0.25$). Net annual discharge was highest in the east; Trout and West Highway Creeks discharged 68% of total annual flow, while McCormick Creek was only 2%.

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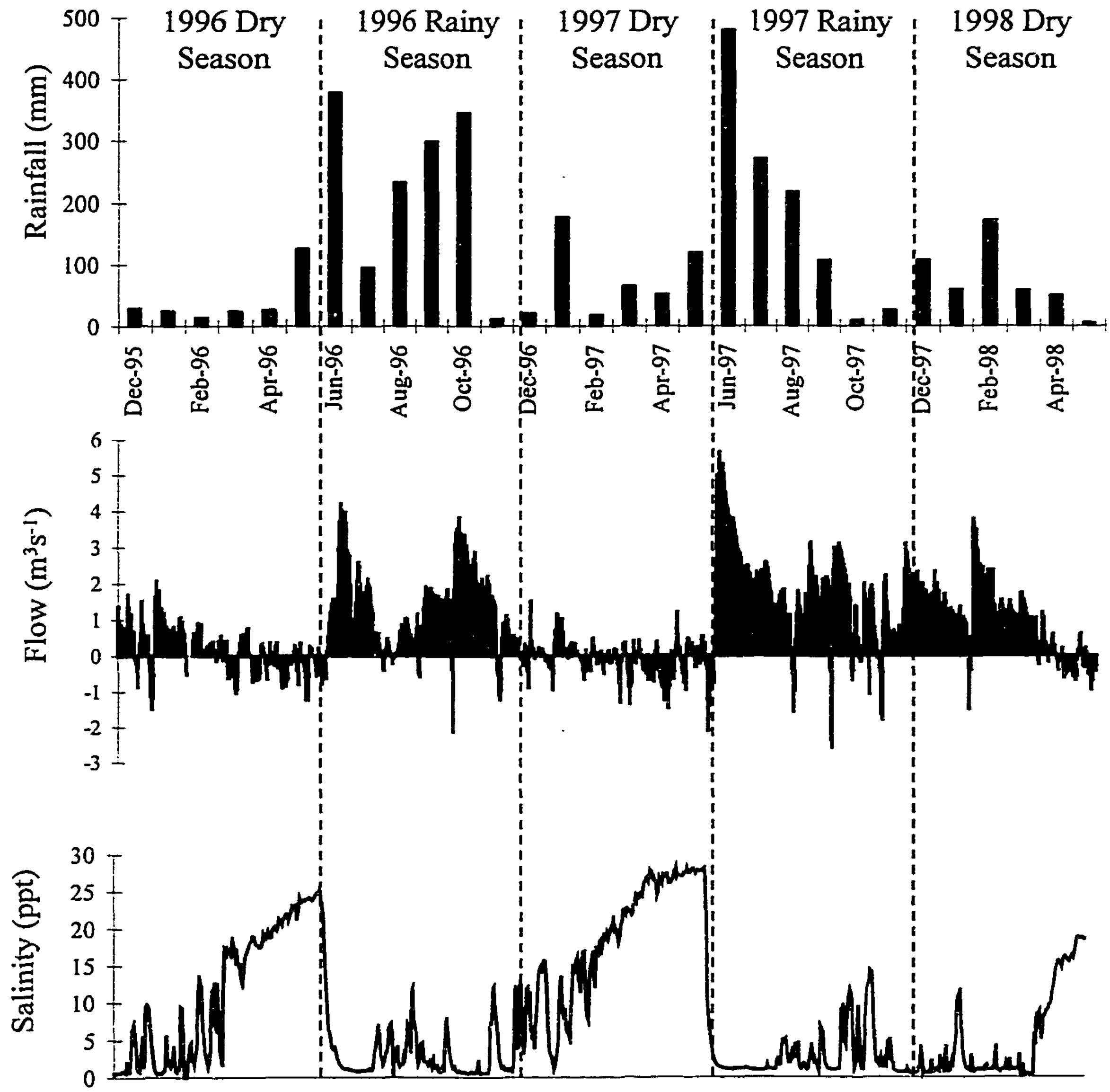

FIGURE 2.2(a) Taylor River rainfall, discharge, and salinity for period of December 1995 - May 1998. Negative discharge is flow into the wetland.

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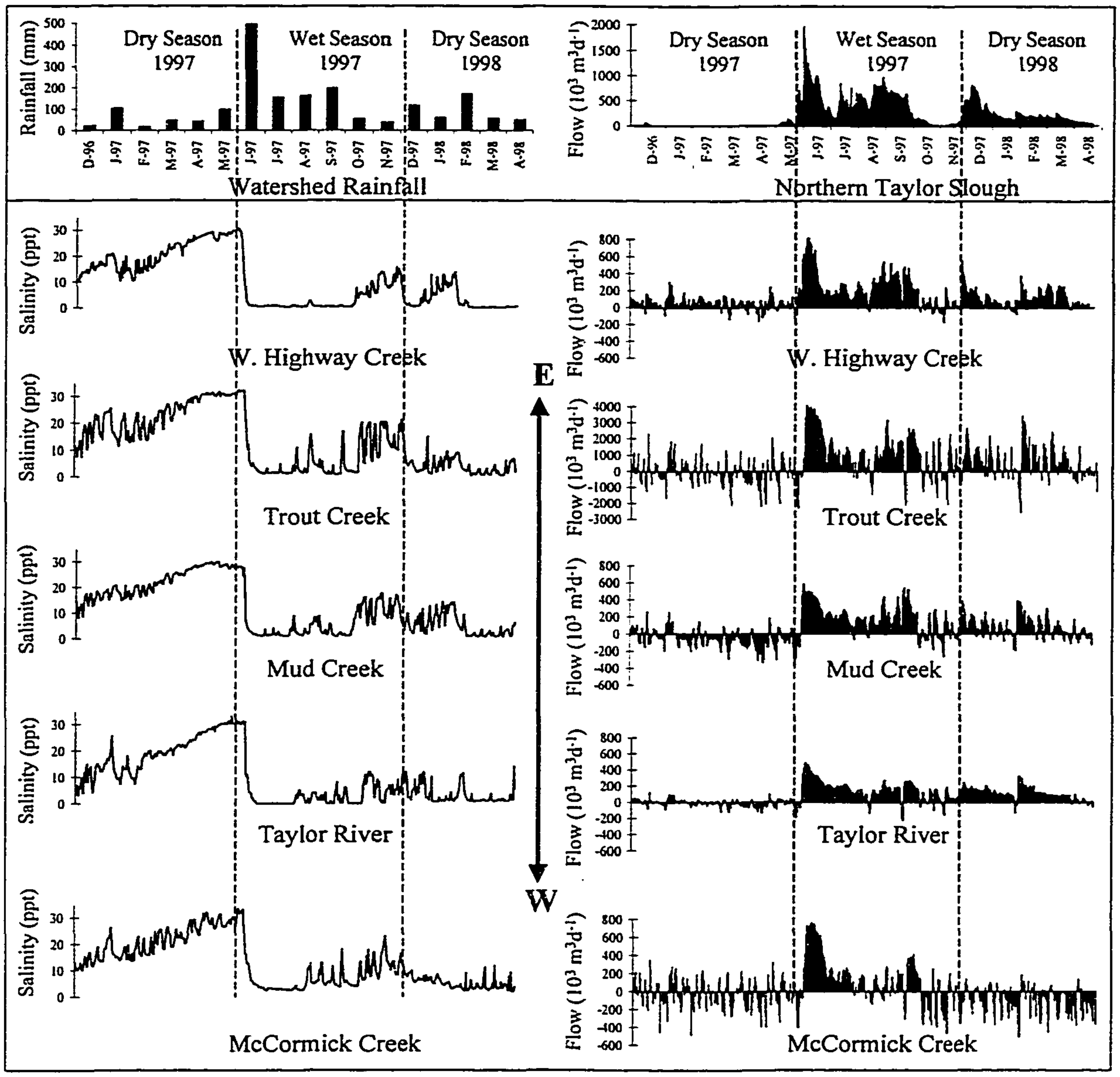

FIGURE 2.2(b) Salinity and discharge at the five creek mouths as a function of watershed rainfall and flow in northern Taylor Slough for the period of December 1996 - April 1998. The x-axis is time months, and negative discharge is flow into the wetland. W. Highway Creek is the eastern-most creek, while McCormick Creek is the farthest west. Note that scale for discharge in Trout Creek is five times that of the other four creeks.

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2.3.2 Dominant Pools of Nutrients and Carbon

Dissolved organic forms comprised the bulk of the total nutrient and organic carbon concentration in all three creeks. In Taylor River, approximately 98% of TOC was in the dissolved organic form, while 92% of TN was DON. Although DOP was not measured in this study, ongoing monitoring work has shown that on average 70-85% of TP is DOP (D. Childers, unpublished data). In all three creeks, dissolved inorganic nutrients made up a very small fraction of the total nutrient pool. NH_4^+ and NO_3^-+NO_2^- represented 4 and 2% of TN respectively. SRP constituted 11% of TP, with a high percentage of samples below detection limit (ranging 13-20%).

2.3.3 Spatio-temporal Patterns in Material Concentration

There were clear spatial patterns in the concentration of nutrients, carbon, and suspended matter among the three creeks. Total nutrient and carbon concentrations increased westward, with McCormick Creek TN and TOC roughly twice as high and TP four times as high as in Trout Creek (Fig. 2.3). High TN:TP ratios in surface waters of the creeks indicate that all three are highly depleted with respect to phosphorus. However, there was a consistent decrease from a yearly mean of 216:1 in the east to 127:1 in the west (Fig. 2.3). The spatial trends for dissolved inorganic nutrients were less pronounced. The mean concentration of NO_3^-+NO_2^- increased slightly from the west towards the east, and mean SRP concentrations in McCormick were twice as high as the eastern creek. These two trends yielded dissolved inorganic N:P ratios which decreased from an average of 120 in Trout to 59 in McCormick (Fig. 2.3). There was no discernable spatial trend in NH_4^+. TSS, POM, and chlorophyll a concentrations in McCormick were approximately

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five times that of Taylor and Trout Creeks, mirroring the same spatial trends that were observed in total nutrient and carbon concentration (Fig. 2.3).

Both Taylor River and Trout Creek showed strong seasonal signals in TOC and TN concentration associated with rainy season forcing, but no strong seasonal variability in TP concentration. The two-year daily record of TN concentration in Taylor River provides detailed resolution of this seasonal pattern (Fig. 2.4). Taylor TN increased 20 - 40 μM during both the 1996 and 1997 rainy seasons, while dry season concentration remained fairly constant at a mean of 51.5 μM. The increase in TN during the 1997 rainy season was one-half that seen in 1996, and coincided with 33% greater creek discharge in 1997 versus 1996 rainy seasons. The mean seasonal concentrations of TOC in Taylor River and TOC and TN in Trout Creek follow this same pattern. Taylor and Trout TOC concentrations were 200 - 330 μM higher, and Trout TN was 20-25 μM higher in August than during all other study periods (Figs. 2.3, 2.5). In contrast to TOC and TN, TP concentrations in Taylor and Trout Creeks were low (0.25 - 0.35 μM) and showed no strong seasonal trends. The daily TP record in Taylor River shows high variability, but the mean trend stayed fairly constant at 0.3 μM. Taylor and Trout TP concentrations were slightly higher at the end of the dry season, although large peak observed in Taylor River daily TP in May 1996 was observed again during the study.

The seasonal TN, TOC, and TP trends observed in McCormick Creek were substantially different than those observed in Taylor and Trout (Fig.2.3). McCormick TN, TOC, and TP concentrations were highest in the dry season months, and decreased during the rainy season. These seasonal differences were largest with TOC and TP, which varied 300 μM and 0.3μM respectively. The trend in McCormick TP was similar to that

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observed in Taylor and Trout, but the magnitude of seasonal variation observed in McCormick was much higher than that of the other creeks. Despite the different seasonal differences in organic carbon and nutrient concentration, all three creeks had a similar salinity regime during the study periods.

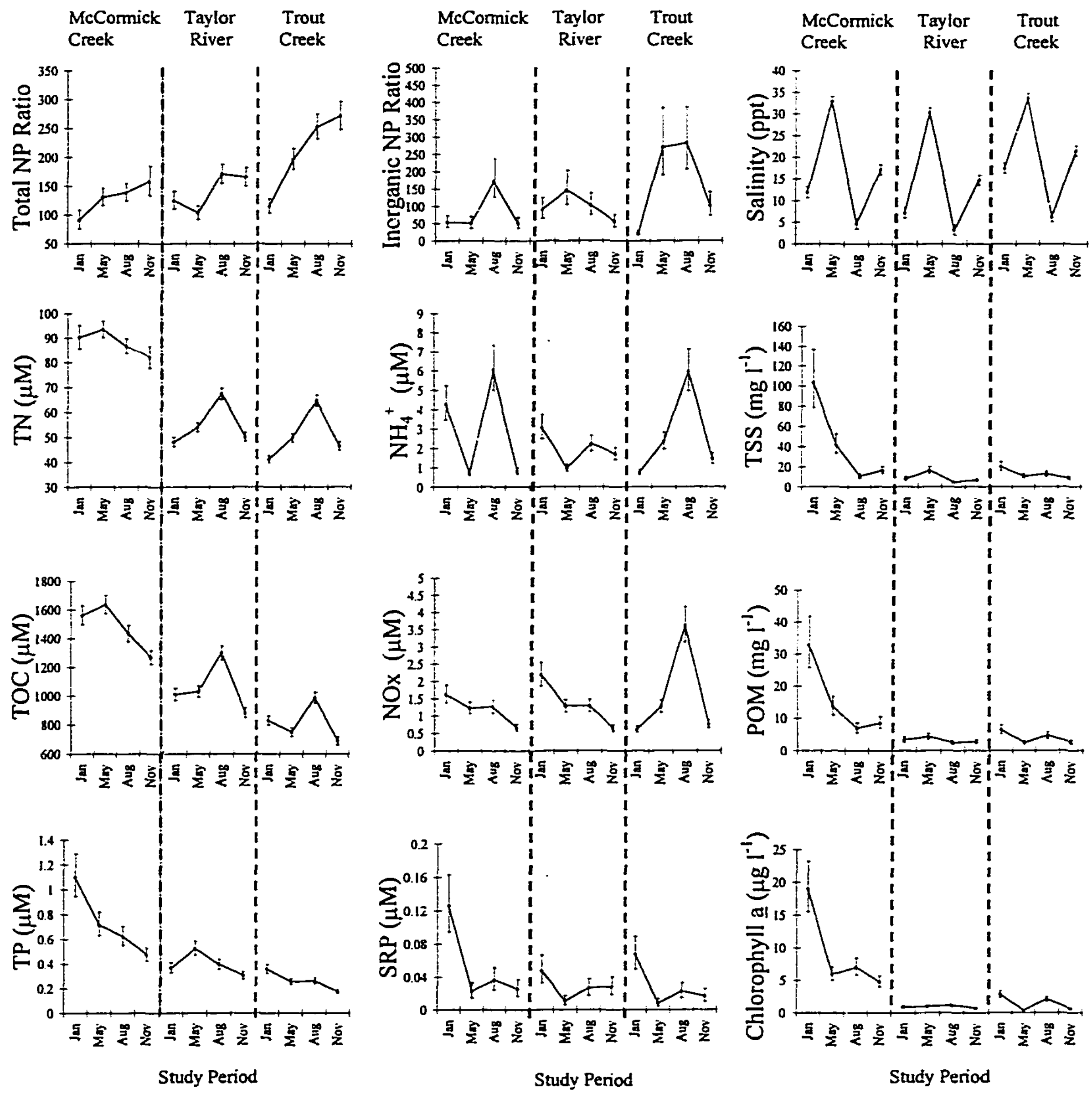

FIGURE 2.3. McCormick, Taylor and Trout Creek mean concentrations of total and dissolved inorganic nutrients and suspended matter during 10-day studies: January 1997 – November 1997. Error bars indicate 95% confidence intervals for mean estimate of each sampling period.

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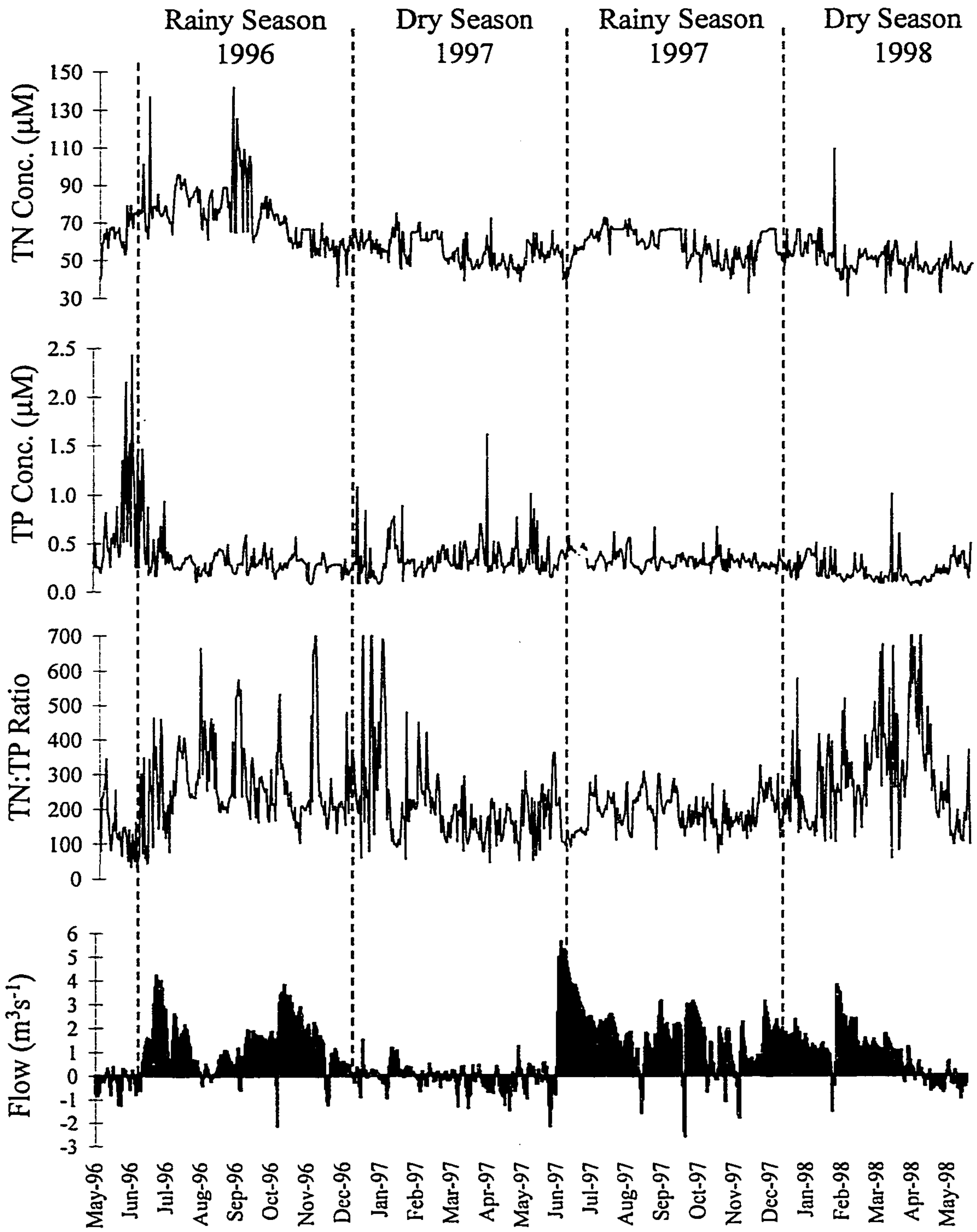

FIGURE 2.4. Taylor R. daily TN, and TP versus daily discharge: May 1996 - May 1998. Negative discharge is flow into the wetland.

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TN:TP ratios in the three creeks were generally higher in the rainy season months, though due to high variability within sampling periods these differences were only significant between sampling periods with the highest and lowest values. In Taylor and Trout Creeks, higher rainy TN:TP ratios result from an increase in TN relative to TP (Fig. 2.3-.4). In McCormick, rainy season increases in TN:TP ratio are due to a larger decrease in TP relative to TN. The lack of similar seasonal trends in inorganic N:P ratios among the creeks was due inconsistent seasonal trends in dissolved inorganic nitrogen (Figs. 2.3,2.5). DIN concentration generally showed peaks in January or August, and, particularly in the case of ammonium, was highly variable. SRP was generally highest in January and lowest in May in all three creeks, with McCormick showing the largest range in concentration.

2.3.4 Relationship between Material Concentration Variables and Indicators of Physical and Biological Forcing

Factor analysis of material concentration and the correlation of these variables with water flow show that creek total nutrient and carbon concentrations were dominated mainly by physical processes. Dissolved inorganic nutrient concentrations appear biologically dominated, while the factors controlling TSS concentration vary by creek (Table 2.2-2.4).

TN, TOC, and TOC in McCormick and TN and TOC in Taylor and Trout grouped as one factor, indicating similar seasonal trends (Tables 2.2-2.4). This confirms the visual analysis of spatio-temporal trends (Fig. 2.3). The strong positive correlation of TOC with flow in all three creeks indicates higher concentrations were associated with flow from the wetlands. This relationship was also positive for TN and TP in the three creeks, but

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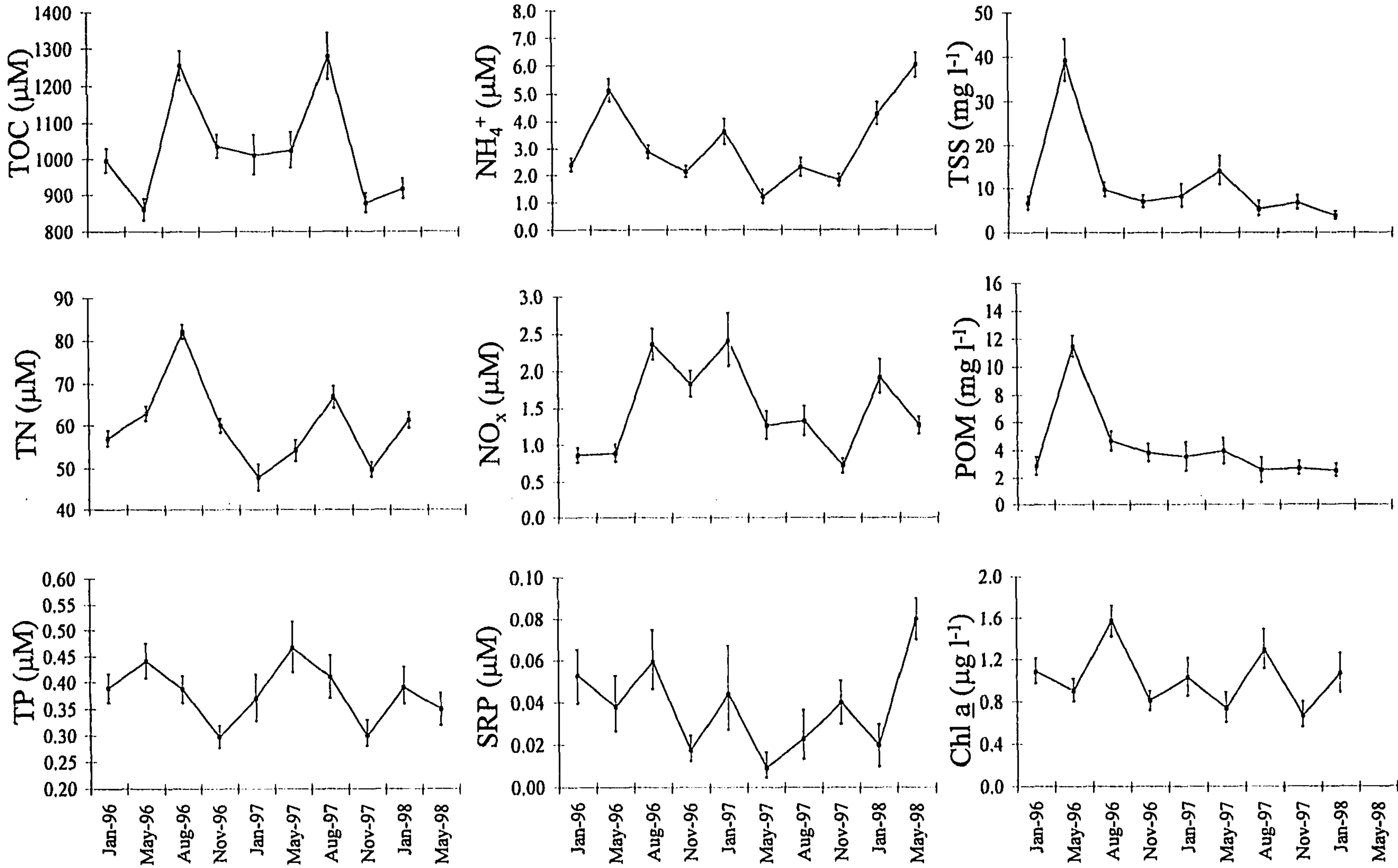

FIGURE 2.5 Taylor River seasonal mean concentrations of total and dissolved inorganic nutrients and suspended matter: January 1996 - May 1998 (10-day studies). Error bars indicate 95% confidence intervals for mean estimate of each sampling period.

only significant for TN in Taylor and TP in Trout. There was a significant positive correlation of water temperature with TN in Taylor and for all nitrogen species and TOC in Trout. This suggests higher concentrations were associated with increased biological activity during the water summer months, but higher water temperatures were coincident with increased freshwater flow, so it is difficult to separate these two effects.

Table 2.2 Factor analysis of McCormick material concentration variables and partial correlation estimates of these variables with water temperature and flow. Numbers in bold represent those material concentration variables which are grouped as one factor, or show correlation of $|r| \geq 0.3$.

	Factor Analysis			**Partial Correlation (r)**	
	Factor 1	Factor 2	Factor 3	Water Temp.	Flow
TSS	**0.88**	0.26	-0.11	**-0.48**	0.06
POM	**0.83**	0.22	-0.17	**-0.40**	0.05
CHL A	**0.71**	0.40	0.11	**-0.51**	0.19
SRP	**0.73**	-0.04	0.38	**-0.48**	0.12
TN	0.06	**0.91**	0.06	0.09	0.05
TOC	0.31	**0.68**	-0.25	0.07	0.25
TP	0.28	**0.80**	0.12	-0.21	0.04
NN	0.08	0.14	**0.87**	0.02	-0.08
NH4	-0.06	-0.12	**0.90**	0.14	-0.04

Table 2.3 Factor analysis of Taylor River material concentration variables and partial correlation estimates of these variables with water temperature and flow. Numbers in bold represent those material concentration variables which are grouped as one factor, or show correlation of $|r| \geq 0.3$.

	Factor Analysis					**Partial Correlation (r)**	
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Water Temp.	Flow
TSS	**0.92**	-0.14	0.01	0.08	0.03	0.20	**-0.48**
POM	**0.92**	-0.02	0.08	0.01	0.02	0.14	**-0.34**
TN	0.04	**0.86**	0.26	0.04	0.03	**0.35**	**0.30**
TOC	-0.22	**0.87**	-0.18	0.11	0.02	0.18	**0.51**
NN	-0.15	0.09	**0.85**	0.12	0.06	-0.23	0.07
NH4	0.28	-0.03	**0.82**	-0.08	-0.01	-0.16	-0.04
TP	0.21	0.20	-0.14	**0.71**	-0.14	0.15	0.06
CHL A	-0.08	-0.04	0.16	**0.85**	0.08	0.09	0.00
SRP	0.04	0.04	0.03	-0.03	**0.99**	-0.14	-0.05

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Table 2.4 Factor Analysis of Trout Creek material concentration variables and partial correlation estimates of these variables with water temperature and flow. Numbers in bold represent those material concentration variables which are grouped as one factor, or show correlation of $|r| \geq 0.3$.

	Factor Analysis				**Partial Correlation (r)**	
	Factor 1	Factor 2	Factor 3	Factor 4	Water Temp.	Flow
TN	**0.92**	-0.09	0.13	-0.19	**0.66**	0.18
NN	**0.94**	0.08	0.07	-0.02	**0.71**	0.14
NH4	**0.96**	-0.02	-0.06	0.02	**0.67**	0.14
TSS	-0.08	**0.94**	0.14	0.03	-0.23	0.10
POM	0.04	**0.93**	0.20	0.04	-0.21	0.20
TP	-0.19	0.21	**0.82**	0.17	-0.26	**0.33**
CHL A	0.09	0.53	**0.62**	0.20	-0.25	**0.36**
TOC	0.48	0.01	**0.74**	-0.15	**0.30**	**0.46**
SRP	-0.11	0.06	0.13	**0.97**	-0.27	-0.02

Dissolved inorganic nutrient concentrations were poorly correlated with flow, suggesting a lack of control by physical forcing. Chlorophyll a co-factored with TP in Trout and Taylor, and with SRP in McCormick Creek. This suggests that either aquatic primary productivity (APP) controls water column phosphorus concentrations, or that phosphorus concentration limits APP. There was no correlation of chlorophyll a with any N species. SRP in Trout and McCormick did not show a strong correlation with other constituents. DIN species were highly correlated in all three creeks (NH_4^+ and NO_3^- &NO_2^-), but did not covary strongly with other constituents. The exception was in Trout, where DIN appeared to track TN concentration. The correlation of water temperature with DIN concentration varied in strength and direction among the creeks. SRP was consistently lower during period with higher water temperatures, although this relationship was only significant in McCormick.

Our analyses suggest that suspended matter concentration in McCormick and Trout was controlled mainly by biological processes, while physical processes control

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TSS and POM concentrations in Taylor (Tables 2.2-2.4). TSS and POM showed a strong positive correlation with chlorophyll a in McCormick (Factor 1, Table 2.2). This correlation was lower but still substantial in Trout (Factor 2, Table 2.4), but was poor for Taylor (Factor 1, Tables 2.3). The relationship between McCormick and Trout TSS and flow was weak though positive, indicating higher concentrations associated with flow from the wetlands. The strong negative correlation of suspended matter with water temperature in Trout and McCormick was driven the high concentrations of these constituents in January 1997 (Fig. 2.3). In contrast to the trends seen in the other two creeks, Taylor River TSS and chlorophyll a concentrations were generally the lowest of the three creeks. TSS in this creek was negatively correlated to direction of flow, with TSS twice as high and POM a third higher during negative flows than during positive (p-values ≤ 0.028). In addition, Taylor TSS concentration was positively correlated with the southerly component of wind velocity (R^2=0.20), while TSS in McCormick and Trout showed little correlation with wind (R^2 = 0.03 and 0.10). Thus Taylor TSS and POM were highest when there were strong, sustained south winds and an influx of Bay water into Taylor River (May), and lowest during periods of high positive flows.

2.4 DISCUSSION

Variation in the degree of hydrologic coupling of the Everglades mangrove wetlands with both the upper watershed and the Gulf of Mexico (GOM) resulted in strong gradients in the amount of freshwater and nutrient inputs to the creek systems. These two factors were the major cause of distinct spatio-temporal patterns in material concentration in creek surface waters.

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The westward decrease in freshwater input from the phosphorus-limited Everglades and the increase in advection of phosphorus-rich GOM waters is responsible for the major spatial gradients in N:P ratios and nutrient concentration among the creeks. Trout, Taylor, and McCormick Creek surface waters were clearly phosphorus limited. Evidence of phosphorus limitation includes 1. high inorganic and total N:P ratios, which in all creeks were an extreme deviation from the Redfield ratio of 16:1; and 2. the grouping of chlorophyll a concentration as a co-factor with TP or SRP rather than TN or DIN. Both of these factors have been noted in previous studies as indicators of phosphorus limitation in Florida Bay surface waters (Boyer et al., 1997; Fourqurean et al., 1993). Spatially, the decrease in creek surface water TN:TP ratio from 212:1 in the east to 127:1 in the west is consistent with similar observations of N:P ratios in Florida Bay surface waters (Boyer et al., 1997; Fourqurean et al., 1992a) and seagrass biomass (Fourqurean et al., 1992a). These findings support the assertion that the GOM, which has a N:P ratio of less than 20:1, is major source of P to the western basin of Florida Bay (Fourqurean et al., 1993; Rudnick et al., in press).

The westward increase in total nutrients and organic carbon concentration can be attributed to a combination of two factors. First, higher nutrient concentrations in the western basin of Florida Bay support the greater productivity of the McCormick Creek system. This greater productivity is reflected in a westward increase in chlorophyll a concentration in creek surface waters, and the greater standing biomass of mangrove forests (C. Coronado, personal communication) and higher sediment oxygen demand (D. Rudnick, unpublished data) in this system versus in the eastern creeks. As with the lower TN:TP ratios, the greater productivity of the McCormick Creek system is a result of its

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closer proximity to advected nutrient inputs from the GOM. Second, comparison of creek discharge patterns illustrates that McCormick is de-coupled from surface freshwater input from the watershed, so its drainage is largely limited to local precipitation and possibly groundwater. This lower watershed freshwater input results in longer residence time for McCormick creek surface waters versus those of Taylor or Trout Creek, both of which had higher net positive discharge and lower mean concentrations of TN, TP, and TOC. In the micro-tidal mangrove wetlands of the SE Everglades, higher residence time would allow extensive leaching and decomposition of organic matter (Mulholland and Kuenzler, 1979; Twilley, 1985), and likely allows the build up of higher material concentrations in surface waters.

The seasonal pulsing of freshwater input to the SE Everglades was responsible for the major temporal patterns in total nutrient and organic carbon concentration. The east to west decrease in freshwater input and its effect on the residence time of the creek surface waters explains the spatial differences in the seasonal concentrations of these constituents. TP concentration in Taylor and Trout were very low, with little seasonal variation. The relative lack of seasonal TP variation in Trout and Taylor is due to the efficiency of freshwater Everglades periphyton and carbonate soils in scavenging water column P before it reaches the mouths of these creeks (Amador et al., 1992; Diaz et al., 1994; Koch and Reddy, 1992; Scinto, 1997). Rainy season increases in TN and TOC concentration in Taylor River coincide with increased freshwater inputs and higher water temperatures, suggesting a source from either upland runoff or higher rates of wetland biological activity. This trend was opposite that of McCormick TN, TOC and TP. These constituents were approximately 30% higher than in Taylor and Trout during the dry

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season , and decreased during the rainy season. The positive relationship of McCormick TN, TP and TOC with salinity and flow eliminates the possibility that a net influx of bay water during the dry season is solely responsible for higher concentrations of nutrients and carbon during this period. In this creek, freshwater input appeared to cause a dilution, but not to levels below the peak rainy season concentrations of these constituents in Taylor and Trout (Fig. 2.3). Thus increased freshwater input during the rainy season resulted in increased nutrient and carbon concentrations where the ambient concentrations were lower (Trout and Taylor), and a dilution where ambient concentrations were higher (McCormick). Increasing freshwater input to the east decreases the residence time of wetland surface waters, and despite seasonally higher TOC and TN concentrations, is responsible for maintaining the relatively higher N:P ratios and lower nutrient regime of the eastern creeks. In addition, large inputs of freshwater from the SE Everglades dilute higher nutrient surface water advected from the western Bay. Thus, our results support the assertion that surface freshwater flow from the Everglades is important to the maintenance of high N:P ratios in Florida Bay (Fourqurean et al., 1993).

Spatio-temporal gradients in dissolved inorganic nutrients were less apparent than in total nutrients. The slight westward increase of SRP is consistent with higher TP concentration to the west, though the number of samples with non-detectable levels of SRP roughly the same in all three creeks (13-20%). Difficulty in measuring such low levels of SRP may explain why chlorophyll a was a co-factor with TP rather than SRP in Trout and Taylor (Boyer et al., 1997; Fourqurean et al., 1993). The high percentage of total nutrients in the dissolved organic form in creek surface waters shows a high degree

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of wetland processing (Nixon, 1980) and a relative a lack of anthropogenic nutrient inputs into the SE Everglades watershed. The high variability, lack of consistent seasonal patterns, and poor correlation with salinity or flow indicate that DIN and SRP concentrations are controlled to a greater extent by biological than by physical forcing. In general, DIN values were higher than typical concentrations in tropical aquatic ecosystems (Boto and Wellington, 1988; Furnas, 1991), a factor which is likely linked to phosphorus limitation in this ecosystem (Fourqurean et al. 1993). Ammonium was the major component of DIN in creek surface waters, and generally twice as high as NO_3^- NO_2^-. Though unusual for freshwater systems, this is typical of tropical mangrove waters (Alongi et al., 1992). In our study area, high ammonium values, particularly during the warmer months, could be related to the suppression of nitrification in reduced sediments, thus increasing the benthic flux of ammonium (D. Rudnick, unpublished data).

Geomorphology of the local drainage basin determined whether the suspended sediment concentrations in creek surface waters were physically or biologically-dominated. Wind-driven resuspension of Florida Bay sediments is an important source of TSS for Taylor River wetlands. The negative relationship of suspended matter with flow, and the positive relationship of TSS with the southerly component of wind speed indicate that southerly winds have the dual effect of re-suspending sediment and causing an influx of Bay water, thus optimizing suspended matter transport into Taylor River wetlands. In the Gulf of Mexico, winter cold fronts, tropical storms, and hurricanes are a major mechanism for sediment transport into coastal wetlands (Baumann et al., 1984; Leonard et al., 1995; Reed, 1989; Rejmanek et al., 1988).

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This physical control of suspended sediment concentrations in Taylor was not as evident in McCormick or Trout, where there was no strong correlation of TSS with flow, salinity, or wind. McCormick and Trout suspended matter grouped in one factor with chlorophyll a (SRP or TP, Tables 3 and 5). While wind-driven sediment resuspension is also a factor in these systems, the strong positive correlation of TSS and POM with chlorophyll a indicates that suspended matter concentration in these two creeks is more influenced by biological rather than physical forcing. This is due to the presence of brackish water lakes north of both these creeks, where suspended matter is more associated with cycles of growth and die-off of phytoplankton and submerged aquatic vegetation. High total nutrient concentrations and high turbidity have been observed following large-scale diebacks of macrophyte communities in the lakes north of McCormick Creek (Morrison and Bean, 1997). In early January 1997, a major die-back of submerged aquatic vegetation (SAV) in the lake just north of McCormick occurred following the passage of a strong cold front with near zero temperatures (personal observation). This event may explain the high suspended matter, TP, and chlorophyll a measured later in the month during our 10-day study (Fig. 2.3). The higher productivity of McCormick Creek system explains why suspended matter concentration is higher there than in Trout. In Taylor River, the coastal ponds of Taylor River are of insignificant size in comparison to dense stands of dwarf mangroves, which can act to shade the water column and trap particulate matter within the wetland (Wolanski, 1995; Wolanski and Ridd, 1986). So suspended matter concentration into this creek system is primarily a function of resuspended sediment advected from the bay. This assertion is supported by preliminary estimates of sediment accretion rates in the wetland of Taylor Slough, which

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show accretion in the mangrove zone an order of magnitude higher than the freshwater marshes (C. Holmes, personal communication).

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CHAPTER 3

SPATIO-TEMPORAL VARIABILITY IN MATERIAL EXCHANGE BETWEEN THE SOUTHEASTERN EVERGLADES WETLANDS AND FLORIDA BAY: II. PATTERNS IN MATERIAL FLUX AND ESTIMATION OF ANNUAL FLUX OF CARBON AND NUTRIENTS

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3.1 INTRODUCTION

Material exchange at the land-sea interface is dependent on the "energy signature" of the coastal environment, or the specific geomorphology, hydrology, and physical forcing regime of each system (Twilley, 1995). The energy signature of the Florida Bay-Everglades system is unique among North American estuaries because of its carbonate sedimentary environment, restricted tidal regime, and sub-tropical climate (Davis, 1940; Light and Dineen, 1994; Lugo and Snedaker, 1974). Phosphorus is the limiting macro-nutrient in both Florida Bay and the southern Everglades, due to the strong affinity that carbonate minerals have for phosphorus (de Kanel and Morse, 1978). The Gulf of Mexico, forming the western margin of Florida Bay, is the major source of phosphorus to the system (Rudnick et al., in press), resulting in a gradient of C:P ratios in the seagrass biomass from high in the eastern Bay to low in the western Bay (Fourqurean et al., 1992a; Fourqurean et al., 1992b; Rudnick et al., in press).

Material exchange between the Southeastern (SE) Everglades wetlands and Florida Bay is poorly understood. Water flows through the Everglades in shallow, broad sloughs, and is channelized into creeks only near the coastline (Davis and Ogden, 1994). The seasonal patterns of precipitation and surface water flow in South Florida, along with the importance of wind-driven circulation in Florida Bay (Wang et al., 1994), are likely to play a dominant role in material exchange. While an extensive water quality monitoring program for the Everglades and Florida Bay exists (Boyer et al., 1997), there has been no direct measurement of material flux at the interface of these two systems. Quantifying the material exchange between the SE Everglades and Florida Bay will

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provide greater understanding of the functional role of these wetlands in controlling material transport across the Everglades-Florida Bay landscape.

Variation in the exchange of material between estuaries and adjacent coastal waters occurs on both temporal and spatial scales (Childers et al., 1993; Smith, 1979). In macro-tidal estuaries, tidal forcing is a dominant determinant of net flux (Kjerfve and McNellar, 1980), and flux studies in such systems have placed an emphasis on monitoring temporal variation in flux over several tidal cycles (e.g. Alongi et al., 1989; Chrzanowski et al., 1983; Dame et al., 1991; Jordan et al., 1986; Woodroffe, 1985, and others). However, significant exchanges driven by non-local forcing can occur with periods greater than that of the tidal cycle (Kjerfve et al., 1978). This is especially true for micro-tidal estuaries. Thus it is important to capture temporal variation in material flux during non-local forcing events such as cold fronts and tropical storms (on the order of 10-18 days-Kjerfve et al., 1978; Leonard et al., 1995) and during different seasons (Childers and Day, 1990a; Childers and Day, 1990b; Stern et al., 1986) rather than variation during several tidal cycles. Spatial variations in hydrology and material concentration compound the complexity of measuring material flux in estuaries (Childers et al., 1993). In the southern Everglades, surface water is discharged from five major creek systems (Davis and Ogden, 1994). These creeks are subject to variable physical forcing due to east-west gradients in freshwater input (McIvor et al., 1994), tidal forcing (Wang et al., 1994), and nutrient inputs from the Gulf of Mexico (Rudnick et al., in press). Therefore, measurement of material flux from the southern Everglades must take into account not only temporal but spatial variation.

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During the past decade, the massive die-off of *Thalassia testudinum* and the increased persistence of algal blooms in western Florida Bay have been attributed to a series of anthropogenic changes that have been occurring in the Everglades and Florida Bay over the past century (Robblee et al., 1991). Among these include a diversion of freshwater to the Atlantic coast through a network of over 2200 km of canals, and a subsequent increase in the salinity of Florida Bay. Hydrological restoration of the southern Everglades, which began in October 1997, will result in the diversion of water from the L-31W canal to Taylor Slough, and increased overland flow by removal of levees from the C-111 canal (SFWMD, 1990). Thus, the goals of these restoration efforts are to increase freshwater flow to NE Florida Bay and to restore the natural hydrology of the southern Everglades by augmenting flow through Taylor Slough relative to flow in the C-111 basin. However, given the sensitivity of oligotrophic ecosystems to allochthonous nutrient supply, it is necessary to know to extent to which there is a net transport of nutrients from the SE Everglades to the bay, and whether increased freshwater flow is likely to result in increased loading, particularly of phosphorus.

The goal of our research program was to determine the physical and biological processes affecting patterns of material concentration and exchange between the SE Everglades and Florida Bay, and how these processes might be affected by increased freshwater flow. Part I of this research addresses factors controlling material concentration (Chapter 2). Part II, presented in this chapter, describes spatio-temporal patterns in material flux, and quantifies annual flux of organic carbon and nutrients from the SE Everglades. Specifically, the objectives of this research are to: 1. quantify the spatio-temporal patterns in hydrological and material exchange between the SE

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Everglades and Florida Bay; 2. determine the physical and biological forcing functions responsible for this pattern; 3. estimate the annual flux of nutrients and carbon from the SE Everglades to Florida Bay; and 4. assess the potential impact of hydrological restoration efforts of nutrient loading to Florida Bay. We hypothesized that 1. material exchange will be controlled by freshwater input and wind rather than tidal forcing, and 2. a decrease in upland drainage towards the western boundary of Taylor Slough in the SW Everglades will result in a decrease in material flux from east to west.

3.2 METHODS

The location of the creek study sites, climate and characteristics of the study area are summarized in the preceding chapter. The SE Everglades watershed, which encompasses Taylor Slough and the wetlands south of the C-111 canal wetlands, will hereto be referred to as the Taylor Slough/C-111 basin (Fig. 2.1).

The material concentrations used in this paper to calculate flux were from the same samples used in the preceding paper to describe spatio-temporal trends in material concentration. For detailed description of field laboratory processing of samples and analytical methods employed to determine material concentration, see Chapter 2.

3.2.1 Flux Study Design and Field Methods

Our study consisted of several water sampling programs designed to characterize temporal and spatial variability in material flux from the SE Everglades wetlands. We chose Taylor River to intensively study temporal patterns. To capture seasonal and inter-annual variability in material flux, we measured daily exchange of total nitrogen (TN) and phosphorus (TP) for two years (May 1996-1998) at a permanent monitoring station located at the mouth of Taylor River. In addition, 10 10-day flux studies were conducted

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seasonally at this location (January 1996 - May 1998). These 10-day flux studies were scheduled to coincide with the seasonal pattern of forcing (Table 1), and involved a higher frequency sampling of a suite of constituents including: total nitrogen (TN), total phosphorus (TP), total organic carbon (TOC), ammonium (NH_4^+), nitrate+nitrite (NO_3^- $+NO_2^-$), soluble reaction phosphorus (SRP), total suspended solids (TSS), particulate organic matter (POM), and chlorophyll a. The combination of these two sampling designs allowed us to investigate the temporal variation in material flux over several time scales (daily, weekly, seasonal, and inter-annual). Spatial variation was assessed by conducting four 10-day flux studies simultaneously in McCormick, Taylor, and Trout Creeks through the period of January - December 1997.

Table 3.1. Summary of Seasonal Forcing Functions in South Florida

Month	**Temperature**	**Rain**	**Frequency of Cold Fronts or High Wind Events**	**Frequency of Trop. Storms & Hurricanes**
January	Moderate	Low	High	Low
May	High	Low	Medium	Low
August	High	High	Low	High
November	Moderate	High	Medium	Medium

During each 10-day flux study, a Sigma 900 autosampler collected a 1-liter sample every three hours from a single point in the water column. Samples were packed in ice and held in the field for a maximum of 21 hours before being transported to the field laboratory for processing. The daily samples, which consisted of a 1-liter daily composite of water drawn four times per day from a single point in the water column, were collected and stored in the field without ice, and processed every three weeks. Continuous discharge and salinity were obtained from USGS acoustic line velocity

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meters deployed at each of the five creeks (AVM, Laenen, 1985; Laenen and Curtis, 1989; Patino and Ockerman, 1997).

3.2.2 Cross-sectional Variations in Material Concentration

It is important to calculate material flux with data that account for cross-sectional variation in both velocity and material concentration (Boon, 1978; Kjerfve et al., 1981). The AVMs in the creeks, which generate velocity from measurements taken at three points along the vertical and have mean absolute error rates ranging from 0.1 - 0.4% (E. Patino, personal communication; Patino and Ockerman, 1997), sufficiently represent cross-sectional variation in velocity. Because our estimates of material concentration were based on sampling a single station in the creek channel, we determined the accuracy of this sampling scheme, using the methodology of Boon (1978) and Kjerfve et al. (1981). Specifically, we evaluated if the mean material concentration of two replicates taken at the proposed sampling point significantly differed from that of nine samples taken throughout the creek cross-section. At the permanent monitoring station, the creek cross-section (ranging in width from 9 m in Taylor River to 30 m in Trout Creek) was divided into 9 sampling points. A sample was taken at each point, and 2 replicates were drawn at the monitoring location. This sampling scheme was conducted eight times in each creek throughout four sampling periods. For each creek, a multivariate analysis of variance (MANOVA) was performed to determine whether there was a significant difference in mean concentration between the monitoring location and the average of nine points in the cross-section (SAS ® PROC MANOVA; SAS, 1989). There was no significant difference in concentration in any of the creeks for any of the constituents tested ($p\text{-value}_{\alpha=0.05}$ = 0.35, 0.99, and 0.17 for McCormick, Taylor, and Trout Creeks,

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respectively). We therefore concluded that the use of a single sampling station to represent mean material concentration in the creek cross-section was acceptable.

3.2.3 Net Three-hour and Daily Fluxes

The methodology we used to calculate flux was similar for both the 10-day study and the long-term, daily Taylor River TN and TP data sets. First, we assumed that the concentration of each constituent was representative of mean concentration during the sampling interval. For the 10-day studies, this sampling interval was 3 hours, while for the daily TN and TP flux measurement the sampling interval was 24 hours. Note that for daily TN and TP flux, the 24-hr concentration value is a composite of four separate water samples. In each case, discharge data were averaged over the time period coinciding with the water sampling interval (three hours or one day), and the mean instantaneous constituent flux per sampling interval i computed as the product of concentration and mean discharge (Eq. 1):

$$F(X)_i = C_i Q_i \qquad \text{Eq. 1}$$

where $F(X)_i$ is the mean instantaneous flux of constituent X in g s^{-1} or mmol s^{-1}, C_i is the concentration of X at sampling interval i, Q_i is the mean discharge for sampling interval i. To compute the net flux for any time period T, the mean instantaneous flux $F(X)_i$ was multiplied with a unit time conversion factor (i.e. seconds to 3 hrs). The products were summed to yield a net total flux for each constituent during the time period in which the study was conducted (i.e. 10 days for the 3-hour flux estimates, or a season or year for the daily TN and TP estimates; Eq. 2):

$$F(X)_T = \sum_{i=1}^{N} F(X)_i \, CF \qquad \text{Eq. 2}$$

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where $F(X)_T$ is the net constituent flux for the time period T, CF is the unit time conversion factor, and N is the number of sampling intervals (e.g. 80 for each 10-day flux study, or 365 for annual flux derived from daily water sampling). Error in the assumption that C_i is representative of the average constituent concentration during the sampling interval i was unknown, so the error in the 3-hour and daily flux estimates was assumed to be the product of the nutrient concentration and the standard error of the discharge.

3.2.4 Prediction of Material Flux

Our goal was to estimate annual material flux from all the creeks. Since a long-term record of TN and TP flux was only available for Taylor River, we hoped to use data from the 10-day studies to derive these material flux estimates in the two other creeks. Preliminary analysis of Taylor River data set indicated that the estimate of annual flux by direct extrapolation of the 10-day flux rates was not feasible because of the dependency of these rates on discharge rate. Continuous USGS discharge data was available for all five creeks, so we explored the possibility of predicting mean instantaneous constituent flux [$F(X)_i$] from 3-hour mean discharge (Q_i) as in Eq. 1. For each creek, one-half of the 10-day study data points were randomly selected, and the mean instantaneous constituent flux [$F(X)_i$] was regressed against 3-hour mean discharge using in a polynomial model (linear, quadratic, or cubic) as given in Eq. 3.

$$F(X)_{i\text{-Predicted}} = \beta o + \beta_1 Q_i + \beta_2 Q_i + \beta_3 Q_i \qquad \text{Eq. 3}$$

where βo is the intercept, β_1, β_2 and β_3 are the regression coefficients, and Q_i is the independent variable. The resulting regression relationship was validated by utilizing the remaining half of the data points, calculating $F(X)_{i\text{-Predicted}}$ from the regression model,

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and comparing this value to observed $F(X)_i$ to determine relative percent error in the estimate. Since the Taylor River 10-day data set was the largest (800 data points), we explored the possibility of using this method for all nine constituents. Based on these results, we chose to develop predictive models in Trout and McCormick Creeks for only those constituents in the Taylor data set that could be predicted with a reasonable amount of error (i.e. <50%).

3.2.5 Estimate of Annual Net Carbon and Nutrient Flux

Taylor River annual TN and TP flux was estimated from direct measurements. Taylor TOC flux and the flux of TOC, TN and TP from Trout and McCormick were estimated with regression equations. We made no measurement of nutrient or carbon concentration in Mud or West Highway creeks. To generate annual flux estimates for these two creeks, we assumed that 1) TN, TP, and TOC flux is strongly dependent on hydrologic regime, and 2) regression equations generated for either McCormick, Taylor, or Trout would adequately represent flux in Mud or W. Highway if the nutrient regimes of the creeks were similar. While no TOC concentration data were available for Mud or West Highway Creeks, we found that mean concentration of TN and TP in monthly water samples in Mud Creek (60.7 and 0.29 μM; E. Patino, personal communication) was comparable to that found in Taylor River (59.4 and 0.33 μM, this study). Mean TN and TP concentration in W. Highway Creek (52.4 and 0.27 μM; E. Patino, personal communication) was comparable to Trout Creek (50.9 μM and 0.28 μM). Therefore, the regression equations generated from Taylor River samples were used to predict annual TN, TP, and TOC flux estimates in Mud Creek, while those from Trout Creek were used to predict flux in West Highway Creek. Flux error rates in Mud and W. Highway Creeks

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were assumed to be the same as those from the Taylor and Trout Creek regression equations. Annual dissolved inorganic nutrient flux was estimated as the product of total nutrient flux and the mean fraction of dissolved inorganic to total nutrient concentration observed during the 10-day studies.

3.2.6 Additional Statistical Analyses and Data Sources

The water quality, meteorological and hydrology data used in these analyses were obtained from the SFWMD DBHYDRO database as described in the preceding chapter.

Additional statistical analyses included an analysis of the relative effect of wind and predicted tidal amplitude on water exchange patterns during the 10-day studies. Predicted tide for L. Maderia Bay, Trout Cove, and Terrapin Bay, the receiving basins for the 3 creeks, was generated using Tides & Currents® Pro for Windows (Nautical Software, 1997). Vector wind velocity was broken down into its N-S and E-W components. Cross-correlations were run between 3-h mean water flow and 0-2 lags of tide and 0-12 hour lags of wind to determine if lags were important to consider in the regressions. The regression of wind and tidal effects on water flow were corrected for serial correlation using an auto-regressive time series model (Bense, 1995). Regressions with Durban-Watson coefficients greater than 1.8 were considered serially correlated, and the first lag of the flow variable was inserted into the model to remove the effect. All statistical analyses were performed using SAS statistical software (SAS, 1989).

3.3 RESULTS

3.3.1 Relationship of Creek Discharge with Physical Forcing

The 2.5 year record of daily creek discharge presented in the preceding paper illustrates two important points about the effect of surface freshwater input on the water

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exchange, and hence material exchange in these creeks systems (see Fig. 2.2(a-b) in Chapter 2). First, the seasonal pulsing of surface freshwater input (either from direct rainfall, canal inputs to the watershed, or groundwater) is responsible for the major variations in magnitude of water exchange in all five creeks. Second, the influence of this freshwater input decreases from east to west. This is well illustrated by the dominance of Trout and W. Highway Creek discharge in total creek output (68%) versus that of McCormick (5%). The deviation of McCormick's discharge pattern from the other four creeks, particularly during the 1998 dry season with abnormally high precipitation and surface water input to the watershed, shows that this creek discharge is probably limited to drainage of local precipitation (Fig. 3.1).

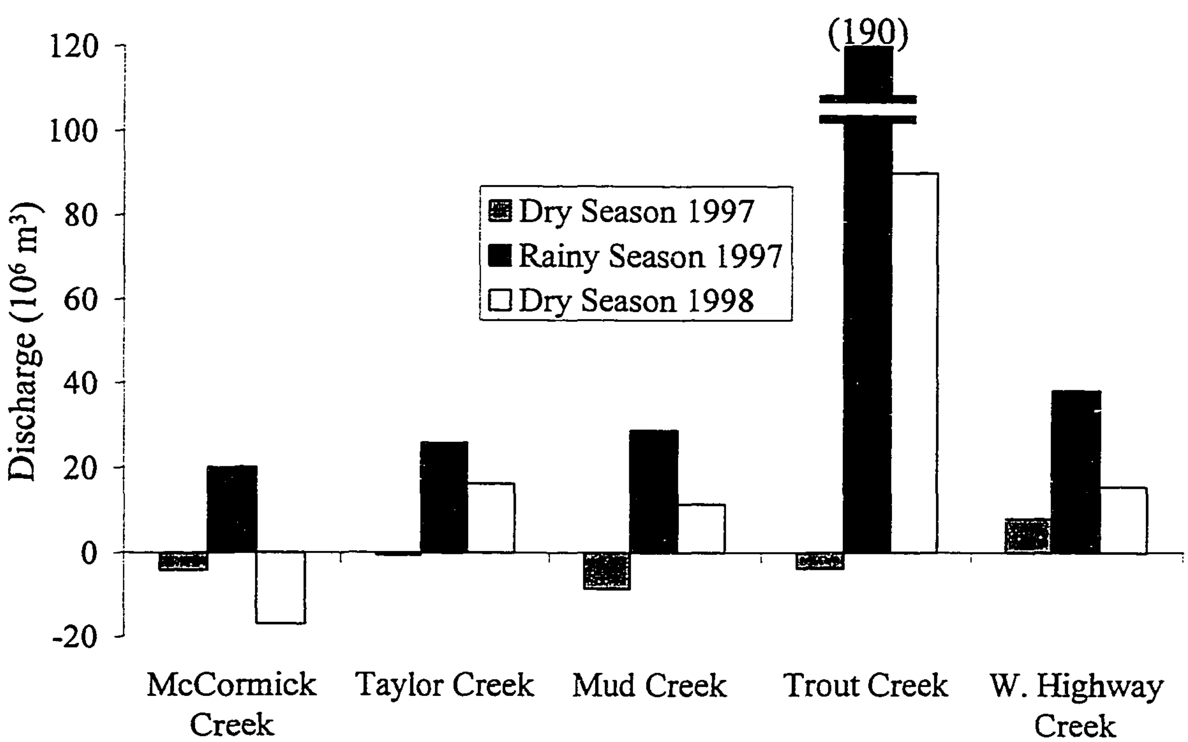

FIGURE 3.1 Net rainy and dry season discharge at the five creek mouths. W. Highway Creek is the eastern-most creek, while McCormick Creek is the farthest west. Negative discharge is flow into the wetland.

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The effect of wind-driven and tidal forcing on creek discharge is manifested on time scales of hours to weeks. Therefore, we analyzed the relative importance of tide and wind on a 10-day time scale (the duration of the short-term studies). We also assessed the impact of pulsing events such as cold fronts and tropical storms on water exchange during these time periods.

Analysis of 10-day discharge patterns show that effect of astronomical tidal forcing increased to the west, but that its effect on water exchange was generally insignificant compared to wind in Taylor Slough/C-111 basin wetlands (Table 3.2-3.3). In Taylor River, tide was significant at the α =0.05 level in only 3 of 10 study periods (May 1996, August 1996 and 1997), while in Trout it was significant in only August 1997. Tide was most significant in McCormick with a range of p-values from 0.009 to 0.057. In the two eastern creeks, tide was a significant predictor of water exchange during periods of very low wind (August), or when the sampling period coincided with a spring tide (May 1996, January 1997).

Table 3.2 P-values of multiple regressions evaluating the relative effect of wind and predicted tidal elevation on McCormick, Taylor, and Trout Creek 3-hour mean discharge, with correction for serial correlation. Abbreviations are follows: NS_WIND = north/south component of wind speed, EW_WIND = east/west component of wind speed, TIDE = predicted tidal height (astronomical). P-values in bold represent significant effects at α =0.05.

Flux Study	Regression Parameters	McCormick p-value	Taylor p-value	Trout p-value
January 1997	NS_WIND	0.000	0.000	0.000
	EW_WIND	0.000	0.001	0.000
	TIDE	0.055	0.051	0.157
May 1997	NS_WIND	0.000	0.000	0.000
	EW_WIND	0.704	0.001	0.123
	TIDE	0.014	0.719	0.449
August 1997	NS_WIND	0.001	0.003	0.006
	EW_WIND	0.787	0.089	0.033
	TIDE	0.009	0.035	0.017

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November 1997	NS_WIND	0.008	0.000	0.000
	EW_WIND	0.998	0.031	0.038
	TIDE	0.057	0.085	0.470

Table 3.3 P-values of multiple regressions evaluating the relative effect of wind and predicted tidal elevation on Taylor River 3-hour mean discharge, with correction for serial correlation. Abbreviations are follows: NS_WIND = north/south component of wind speed, EW_WIND = east/west component of wind speed, TIDE = predicted tidal height (astronomical). P-values in bold represent significant effects at $\alpha = 0.05$.

Regression Parameter	Jan 1996	May 1996	Aug 1996	Nov 1996	Jan 1997	May 1997	Aug 1997	Nov 1997	Jan 1998	May 1998
NS_WIND	**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.003**	**0.000**	**0.000**	**0.009**
EW_WIND	0.252	**0.000**	**0.051**	**0.000**	**0.000**	**0.000**	0.088	**0.030**	**0.000**	**0.000**
TIDE	0.273	**0.034**	**0.037**	0.068	0.051	0.719	**0.035**	0.085	0.063	0.578

The 10-day discharge patterns in the three creeks were dictated by the effects of wind-driven forcing superimposed on the magnitude of freshwater input (Fig. 3.2). Wind-driven forcing caused significant deviations of creek discharge from watershed flow patterns. Wind (usually the N-S component) was a highly significant predictor of flow in all three creeks during each study period (Tables 3.2-3.3). In most study periods, this relationship was optimized with a 3 to 6 hour lag of wind speed. Wind was most significant during those study periods with the passage of a tropical depression (November 1996, Fig. 3.3) or strong cold fronts (January and November 1997, Fig. 3.2). Wind was also important during the latter part of the dry season, when strong sustained southerly winds and low freshwater head resulted in a net flow of water into the wetland (May 1996 and 1997, Fig. 3.2-3.3). This mechanism is responsible for salinities of 20-30 ppt extending as far as 5 km north of the creek mouths (personal observation). The response of creek discharge to dry season wind-driven forcing is most evident in

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McCormick due to the lack of freshwater input in this creek (see Fig 2.2(a,b) in Chapter 2).

Wind-related pulsing events such as tropical storms or cold fronts resulted in significant wetland flushing (Fig. 3.2). The 10-day total volume of water exchanged during one of these events often exceeded that of peak rainy season discharge rates. One

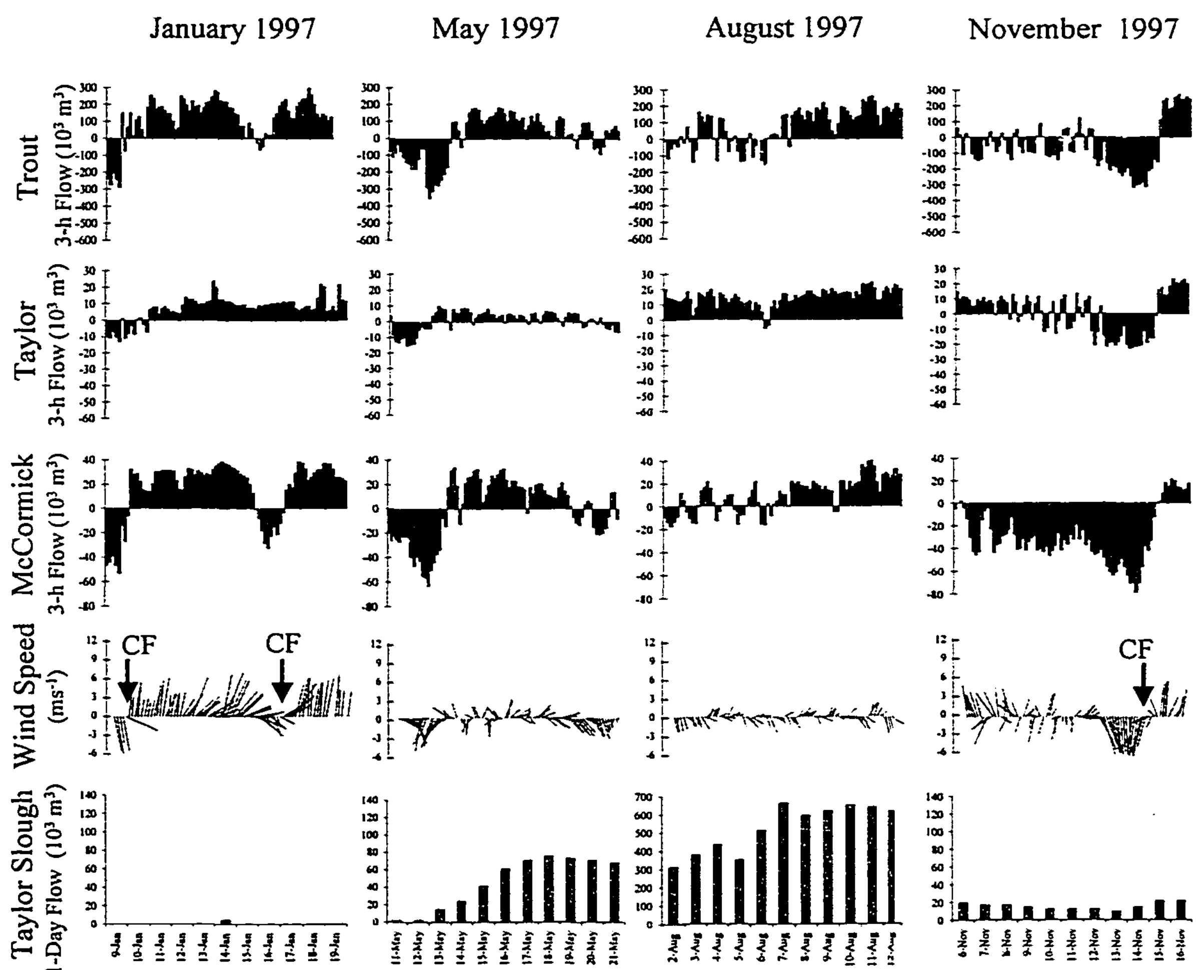

FIGURE 3.2 McCormick, Taylor and Trout Creek 3-hour net flow versus vector wind speed during the 10-day flux studies and flow in northern Taylor Slough. The x-axis is time (10 days) in 3 hour increments for flow and wind speed, and one day increments for flow in Taylor Slough. Negative discharge is flow into the wetland, and positive wind speeds indicate winds from the north. Note differences in scale of flow among the three creeks, and among seasons for northern Taylor Slough flow. Cold front passages are indicated as CF.

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extreme example of this was the passage of a tropical depression during the November 1996 study in Taylor River (Fig. 3.3). This storm produced E-NE gale-force winds with maximum sustained speeds of 10.1 - 13.4 ms^{-1} for two-thirds of the study period. This caused sea-level set down in Florida Bay, and water levels at the mouth of Taylor River dropped 33 cm. As a result, flow increased to peak of 2.09 m^3s^{-1}, the highest outflow measured during all 10 studies. Following the passage of the tropical depression on November 18, 1996, winds subsided, and flow reversed direction to restore creek water levels to pre-storm levels. Cold fronts, which occur with a higher frequency than tropical storms, can also result in significant flushing. One example was in the January 1997 study period, during which three cold fronts passed in rapid succession (Fig. 3.2). The

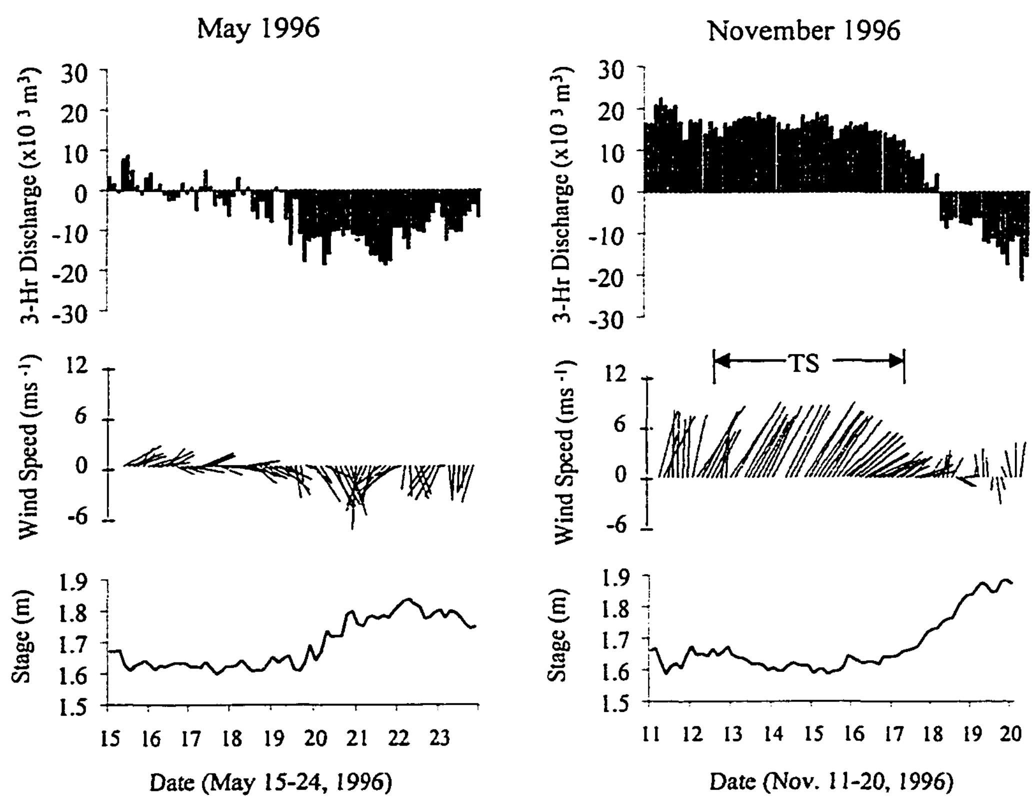

FIGURE 3.3 Taylor River mouth 3-hour net discharge and stage as a function of vector wind speed during the 10-day flux studies. The x-axis is time (10 days) in 3 hour increments. Negative discharge is flow into the wetland. Positive wind speeds indicate winds from the north. Abbreviations are as follows: TS = Tropical storm passage

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strong northerly winds associated with these fronts caused a set down of 38 cm in Taylor River, the highest water level fluctuation observed in the ten flux studies.

All creeks responded simultaneously to wind-driven forcing, but the magnitude of response in McCormick and Trout discharge was much greater relative to Taylor discharge. For example in January 1997, freshwater input in northern Taylor Slough was minimal, and water discharge patterns in all creeks follow the shift between northerly and southerly winds (Fig. 3.2). However, Taylor discharge remains positive, despite strong south winds prior to passage of cold front, while Trout and McCormick discharge becomes negative. This differential in response to wind is also found in November 1997 during the passage of a cold front (Fig. 3.2). The pattern is more complex, possibly due the influence of surface water input to the eastern-most creeks. Prior to the passage of the cold front, sustained southerly winds up to 8.6 ms^{-1} caused sea level set up in Florida Bay. In response, net discharge in McCormick was highly negative for most of the study period, while net discharge in Trout and Taylor was positive.

3.3.2 Seasonal and Interannual Variability in Nutrient Flux: Taylor River

The seasonal and inter-annual patterns in TN and TP flux from Taylor River were controlled by variation in surface freshwater input (Fig. 3.4). The flux estimates for the second year of the study exceeded those for the first year (Table 3.4). Net annual TN flux rose from 20.3 Mg in the first year to 32.6 Mg in the second year, and TP flux rose from 0.201 to 0.398 Mg. This large difference in TN and TP flux estimates between study years was due mainly to the lack of a true dry season in the spring of 1998. The effect of increased surface freshwater input on TN flux was not entirely proportional to flow. The

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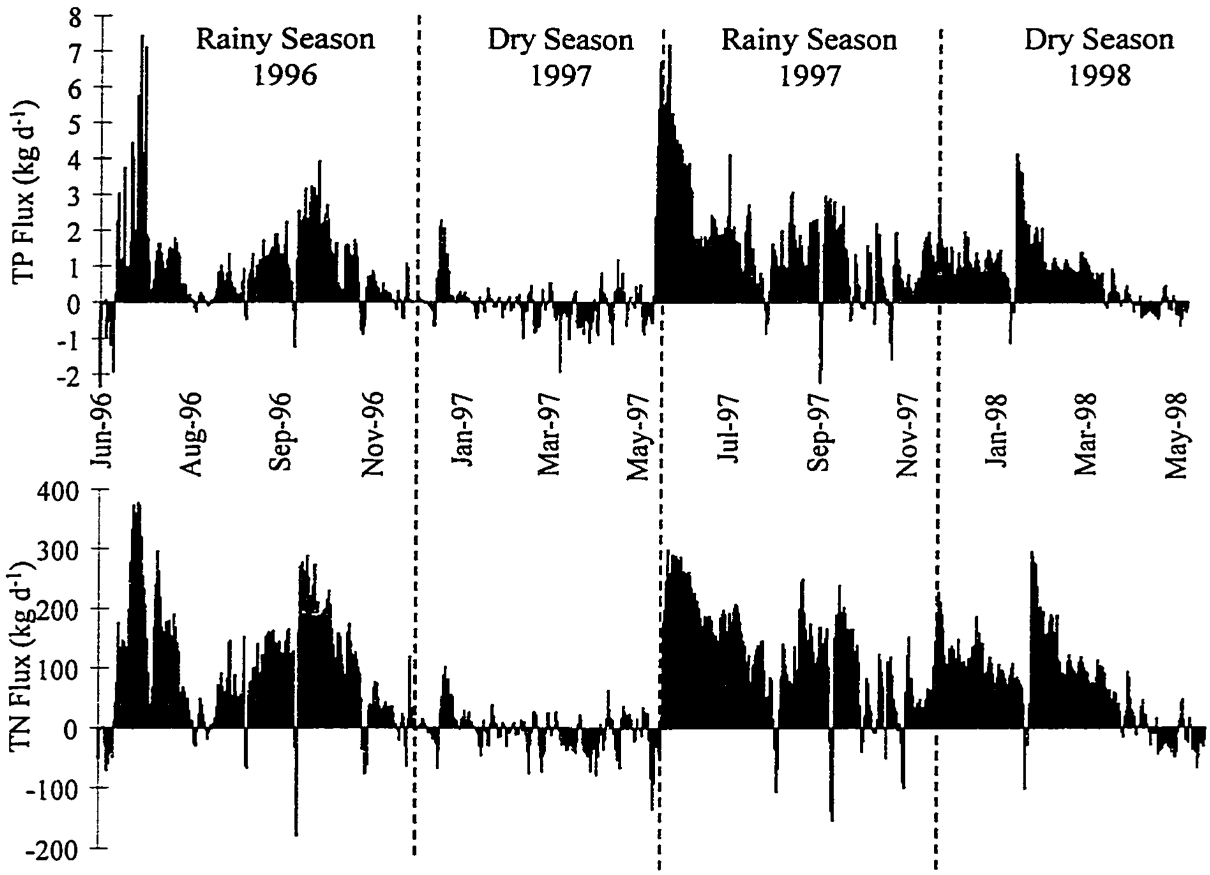

FIGURE 3.4 Two-year record of daily flux of TN and TP at Taylor River mouth. Negative flux is an import into the creek.

110% increase in surface water flow from the previous year resulted in a 60% increase in TN flux and a 96% increase in TP. This implies a 50% decrease in the flow-weighted mean concentration of TN and a 14% decrease in TP. Because the decrease in TN was larger than that of TP, the mean molar TN:TP ratio dropped from 221:1 to 181:1 in the second year of the study (Fig. 3.4).

Table 3.4. Comparison of study Year I and II net annual and seasonal water, TN, and TP flux. Absolute errors of estimates are in parentheses.

Flux Estimates	*Year I (6/1/96 –5/31/97)*			*Year II (6/1/97–5/31/98)*		
	Rainy Season	Dry Season	Total	Rainy Season	Dry Season	Total
Water (10^6 m^3)	20.1	-0.4	19.7 (0.7)	25.6	15.8	41.3 (1.4)

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TN Flux (Mg)	20.3	-0.02	20.3 (1.2)	20.8	11.8	32.6 (2.0)
DIN Flux (Mg)			1.9			3.0
TP Flux (Mg)	0.201	0.002	0.203 (0.028)	0.287	0.111	0.398 (0.05)
SRP Flux (Mg)			0.017			0.033

3.3.3 Spatio-Temporal Patterns in 10-day Material Flux

The seasonal and spatial variation in material flux was primarily due to the magnitude and variation in water discharge rates rather than in material concentration. Net 10-day material flux from Trout Creek was generally much greater than from the other two creeks because its discharge was an order of magnitude higher. McCormick material flux was generally higher than Taylor flux during study periods in which there were cold fronts (January and November 1997), but lower than Taylor during typical rainy season (August 1997, Fig. 3.5). The general pattern revealed by the 10-day flux estimates in all three creeks is one of net export for all studies except May 1996 and November 1997. During these two periods strong southerly winds caused a large net influx of water into the creeks (Fig. 3.5-3.6).

There were a few examples where variability in material concentration controlled material flux. The January 1997 export of chlorophyll a, SRP, TP, and TSS in McCormick fluxes equaled those of Trout due to the extremely high concentrations of these constituents during this time period (Fig. 3.5 and Fig. 2.4 in Chapters 3 and 2). There was a consistent import of TSS into the creeks during the May sampling periods. Water flowing into the creeks during these periods had much higher TSS concentrations than water flowing out (Fig. 3.5-3.6).

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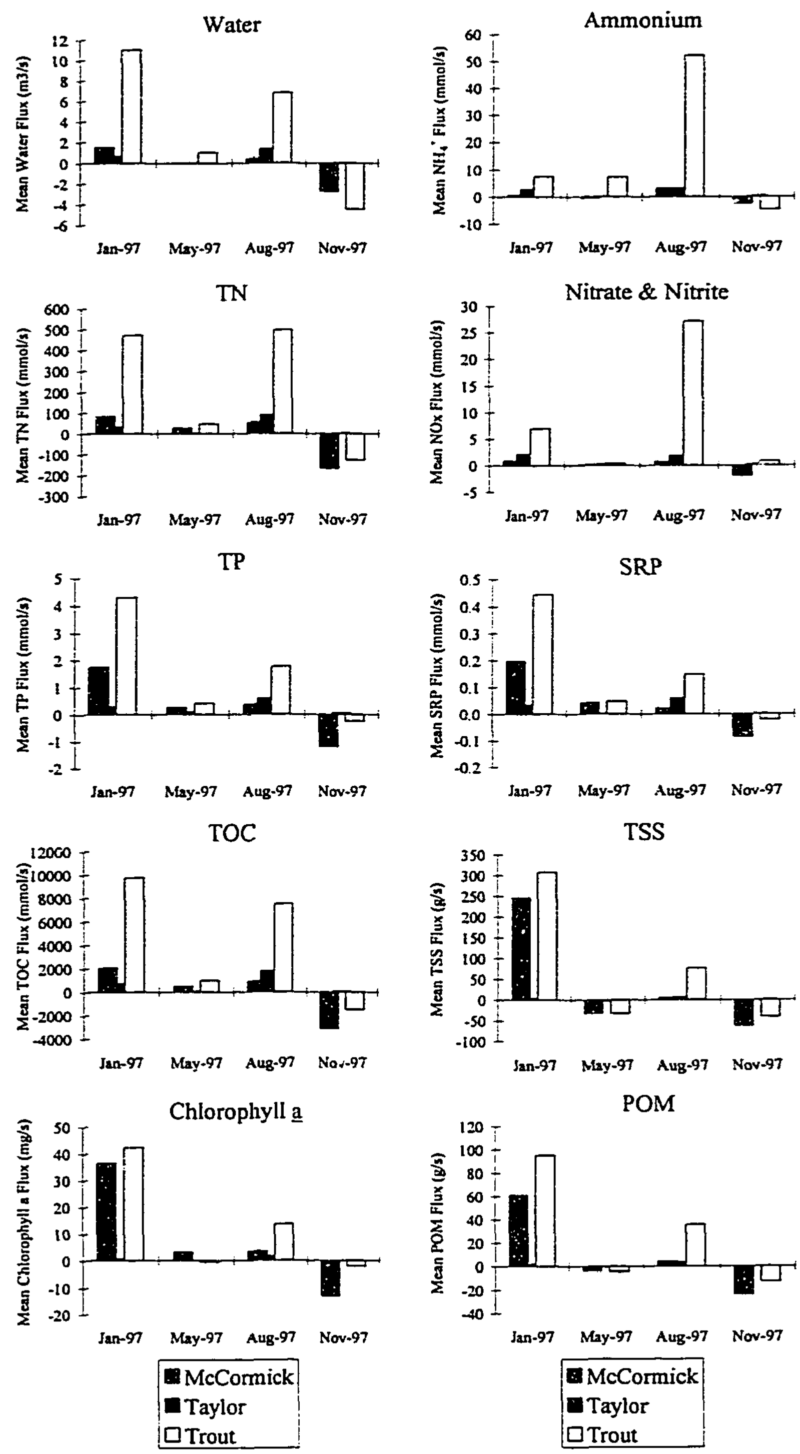

FIGURE 3.5 McCormick, Taylor and Trout Creek 10-day material flux estimates: January 1997 - November 1997. Negative flux is an import into the creek.

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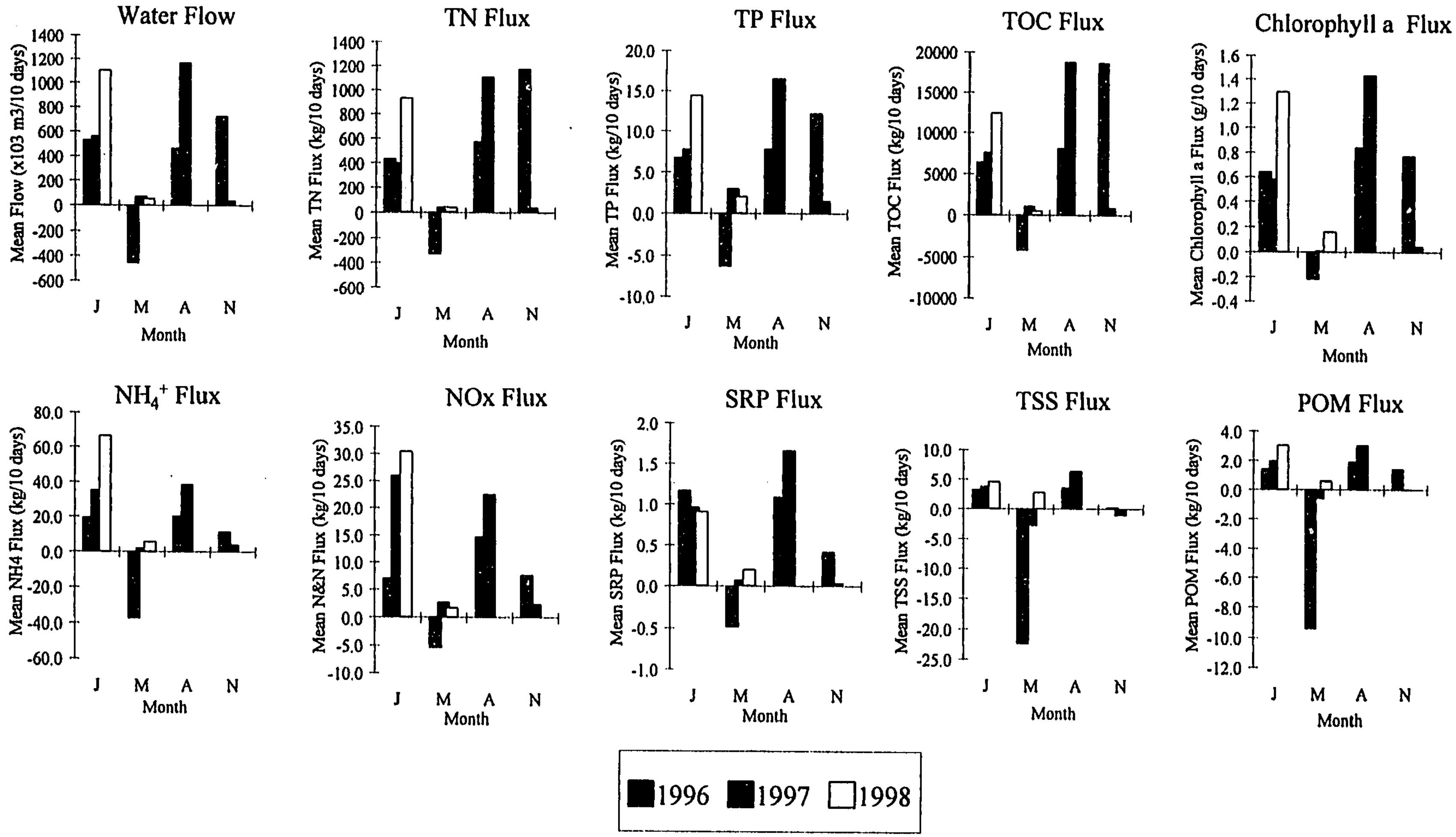

FIGURE 3.6 Taylor River 10-Day net material flux estimates: January 1996-May 1998. Negative flux is an import into the wetland.

Organic carbon dominated the material export, comprising 91.2% by weight of the total C, N, and P flux. Approximately 8.7% was N and 0.1% was P. The fraction of dissolved inorganic to total nutrient flux in all three creeks was small, with dissolved inorganic nitrogen (DIN) and SRP representing approximately 6% and 10% respectively of total nutrients exported. In most cases, 10-day flux estimates conducted during the same month of different years yielded substantially different material flux estimates (Fig 3.6). This result is due to the different hydrological and meteorological conditions captured during each time period, as shown in the graph of net 10-day water flux in Taylor River shown in Fig. 3.6.

3.3.4 Prediction of Material Flux

The utilization of creek discharge to predict total nutrient and organic carbon flux was satisfactory. However, this method was not adequate to predict dissolved inorganic nutrients and suspended matter, and we did not attempt to use this method to quantify the annual flux of these constituents. In all three creeks, the regression equation to predict TOC, TN, and TP flux had high correlation coefficients (R^2 ranging from 0.83 to 0.99) and error rates ranging from 9.5% to 35.1% (Table 3.5). This indicates that the flux of these constituents is controlled to a great extent by discharge rather than concentration.

Prediction of dissolved inorganic nutrient and suspended matter flux in the three creeks was less successful (e.g. Taylor River regressions, Table 3.6). The percent error and correlation coefficients for prediction of Taylor inorganic nutrient and suspended matter concentration were generally higher than those for Trout and McCormick because of the larger sample size from which the equations were derived (N = 400 for Taylor versus N = 160 for Trout and McCormick). The error rate for the prediction of

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chlorophyll a flux was within the same range as dissolved inorganic nutrients (40-52%), while the prediction of the other particulate constituents was poorer, with error rates ranging from 147 to 192%. Because of the large error rates, predicted flux of TSS, and POM are not distinguishable from zero.

Table 3.5. Regression equations, R^2, and median percent error in predicting 3-hour TOC, TN, and TP flux. Predicted flux is in mmoles s^{-1}. The independent variable (mean 3-hr instantaneous flow or Q_i) is in m^3s^{-1}

Creek	Regression Equation	R^2	Median % Error
McCormick Creek	$F(TOC) = 1431.8 * Q_i$	0.98	11.5
	$F(TN) = 81.6 * Q_i$	0.99	9.8
	$F(TP) = 0.598 * Q_i - 0.0067 * Q_i^2$	0.83	35.1
Trout Creek	$F(TOC) = 796.2 * Q_i + 4.4 * Q_i^2$	0.98	12.1
	$F(TN) = 49.9 * Q_i$	0.95	14.4
	$F(TP) = 0.288 * Q_i$	0.87	27.4
Taylor River	$F(TOC) = 984.0 * Q_i + 102.5 * Q_i^2$	0.98	15.3
	$F(TN) = 57.11 * Q_i + 1.62 * Q_i^2$	0.95	9.5
	$F(TP) = 0.420 * Q_i + 0.035 * Q_i^2 - 0.017 * Q_i^3$	0.85	25.2

Table 3.6. Regression equations and percent error in predicting 3-hour dissolved inorganic and suspended matter flux in Taylor River. Predicted flux of TSS and POM is in units of g s^{-1}, while chlorophyll a is in mgs^{-1}. All other constituents are in mmoles s^{-1}. The independent variable (mean 3-hr instantaneous flow or Q_i) is in m^3s^{-1}

Parameter	Regression Equation	R^2	Mean % Error
NH_4 Flux	$F(NH4) = 3.10 * Q_i$	0.77	40.4
N&N Flux	$F(NN) = 1.70 * Q_i + 0.097 * Q_i^2 - 0.1019 * Q_i^3$	0.75	42.1
SRP Flux	$F(SRP) = 0.045 * Q_i + 0.0039 * Q_i^2 - 0.006 * Q_i^3$	0.50	51.5
TSS Flux	$F(TSS) = 16.3 * Q_i - 6.63 * Q_i^2$	0.51	192.1
POM Flux	$F(POM) = 6.40 * Q_i - 2.31 * Q_i^2$	0.71	113.8
Chl. a Flux	$F(CHL) = 0.97 * Q_i + 0.096 * Q_i^2$	0.72	42.6

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Finally, the comparison of Taylor River TN and TP flux predicted from 3-hour mean discharge against measured daily flux is another way to validate the adequacy of our predictive equations. For both study years, predicted annual flux of TN and TP was within the range of error of the measured values (Table 3.7).

Table 3.7. Annual TN and TP Flux: Measured versus Predicted from Daily Flow-Based Equations. Absolute error estimates are in parentheses. Year I is defined as June 1, 1996 – May 31, 1997; Year II is June 1, 1997 – May 31, 1998

Constituent	Year I Flux: Predicted (Mg)	Year I Flux: Measured (Mg)	Year II Flux Predicted (Mg)	Year II Flux Measured (Mg)
TN	17.9 (1.9)	20.3 (1.1)	36.6 (4.1)	32.6 (1.98)
TP	0.25 (0.06)	0.20 (0.03)	0.51 (0.13)	0.44 (0.05)

3.3.5 Estimate of 1997 Annual TOC, TN, and TP Export from the SE Everglades

The 1997 annual export of TOC, TN, and TP from the Taylor Slough/C-111 basin to Florida Bay was estimated to be 4136.6, 242.6, and 3.2 Mg with combined relative error rates of 6.3%, 9.7%, and 16.2% respectively (Table 3.8). Based on these estimates, the flow-weighted, molar TN:TP ratio of material exported was 170:1. Trout Creek dominated the flux of TOC, TN, and TP from the five creeks, exporting 57% of the TP, and 59% of the TOC and TP (Fig. 3.7). With only 4 % of total discharge to Florida Bay, McCormick Creek exported 6% of TN, 7% of TP, and 5% of TOC flux, due to higher concentrations of these materials in this creek. Rainy season discharge accounted for 95-99% of organic carbon and nutrients. Dry season flux was usually negative, with the exception of TOC and TP flux in Trout, and TOC, TP, and TN flux in W. Highway. Carbon dominated the sum of total carbon and nutrient flux (93.8%), while TN accounted for 6.1%, and TP constituted the smallest fraction at 0.1%.

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Table 3.8. 1997 Estimates of Taylor Slough/C-111 Basin annual C, P, and N flux to Florida Bay. Values in parentheses represent absolute error

	Taylor Slough/C-111 Basin Export to Florida Bay
Annual Discharge (10^6 m^3)	323 ± 25
Annual TN Loading (Mg)	242.6 ± 23.6
DIN Loading (Mg)	15.1
Annual TP Loading (Mg)	3.17 ± 0.53
SRP Loading (Mg)	0.33
Annual TOC Loading (Mg)	4136 ± 263
Flow-weighted Mean TN (μM)	53.5
Flow-weighted Mean TP (μM)	0.32
Flow-weighted mean TOC (μM)	1064
Molar TN:TP	170

3.4 DISCUSSION

Estuarine biogeochemical gradients arise from differences in sub-basin geomorphology, freshwater input, and proximity to coastal ocean. These gradients result in spatio-temporal variations in the magnitude and direction of material exchange between estuarine sub-basins and the estuary (Childers et al., 1993; Dame and Gardner, 1993). Variation in the degree of hydrologic coupling of the Taylor Slough/C-111 basin wetlands with both the upper watershed and the Gulf of Mexico (GOM) resulted in strong gradients in the amount of freshwater and nutrient inputs to the creek systems (see Chapter 2). These two factors were the major cause of distinct spatio-temporal patterns in material concentration and exchange between the Taylor Slough/C-111 basin wetlands and Florida Bay.

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3.4.1 Surface Freshwater Input

The seasonal pulsing of freshwater input, and the decreasing influence of this input from east to west, was the most important element responsible for spatio-temporal variation in water and material exchange. Evidence for this includes: 1. export-dominated exchange, 2. westward decrease in net annual flux of nutrients and organic carbon, with net export from the two eastern creeks (Trout and W. Highway) representing approximately 80% of the flux to Florida Bay, 3. large seasonal variation in flux, with 95-98% of C, N and P exchanged during rainy season, and 4. strong coupling of discharge in the four eastern-most creeks with watershed surface water input, while McCormick discharge was limited to drainage from local rainfall. Unseasonably heavy rainfall in S. Florida during the 1998 dry season, associated with the 1997 El Nino (Sun and Furbish, 1997), greatly amplified these spatial differences in freshwater influence among the five creeks, and illustrated how the timing and quantity of freshwater input can alter seasonal water discharge patterns from the southern Everglades. A 45% increase in Year II surface water flow in northern Taylor Slough resulted in a two to ten-fold increase in discharge in the four eastern-most creeks. McCormick Creek discharge actually decreased two-fold, indicating limited coupling with the major surface water flow from the watershed.

3.4.2 Spatio-Temporal Gradients in Material Concentration

Spatio-temporal gradients in total nutrient and organic carbon concentration were not as significant as hydrologic regime in determining overall flux patterns. Three-hr mean creek discharge predicted from 83 to 99 % of the variation in TN, TP, and TOC flux from these three creeks. The higher productivity and nutrient concentrations of McCormick Creek system disproportionately increased its contribution of TN, TP, and

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TOC flux relative to its contribution of water flux (see Chapter 2). This is reflected in the slightly higher error rates associated with TN, TP, and TOC prediction in this creek.

The high temporal variability of dissolved inorganic nutrient and suspended matter concentration was more important in predicting flux of these constituents, as evidenced by the high error rates associated with predicting the flux from water flow. We noted that the high temporal variability of dissolved inorganic nutrients is likely a result of the low concentrations relative to total nutrients, and the biological rather than hydrologic control of dissolved inorganic nutrient concentration (see Chapter 2).

3.4.3 Wind-Driven Forcing

Wind-driven forcing was an important determinant of material exchange between Florida Bay and the Taylor Slough/C-111 basin. The shallow bays and estuaries of the Gulf of Mexico are highly susceptible to forcing from wind stresses (Solis and Powell, 1998; Ward, 1980), and Florida Bay is no exception (Wang et al., 1994). On a seasonal scale, the effect of this forcing was most important when low freshwater head during the dry season coincided with strong southerly winds, resulting in a net import of water and materials into the wetlands. Spatially, this effect was most visible in McCormick Creek because of the relative lack of surface water input (Fig 2.2(b) in Chapter 2). On time scales of 10-14 days, wind-driven forcing could exaggerate or overwhelm forcing from freshwater input. This effect was most visible with the passage of tropical storms and strong cold fronts. In the northern Gulf of Mexico, the impact of these storms on water and material exchanges in wetlands has been well documented (Moeller et al., 1993; Reed, 1989; Smith, 1977; Wang et al., 1994). While the energetic forcing of a cold front is small relative to a tropical storm, its cumulative impact may exert a greater influence

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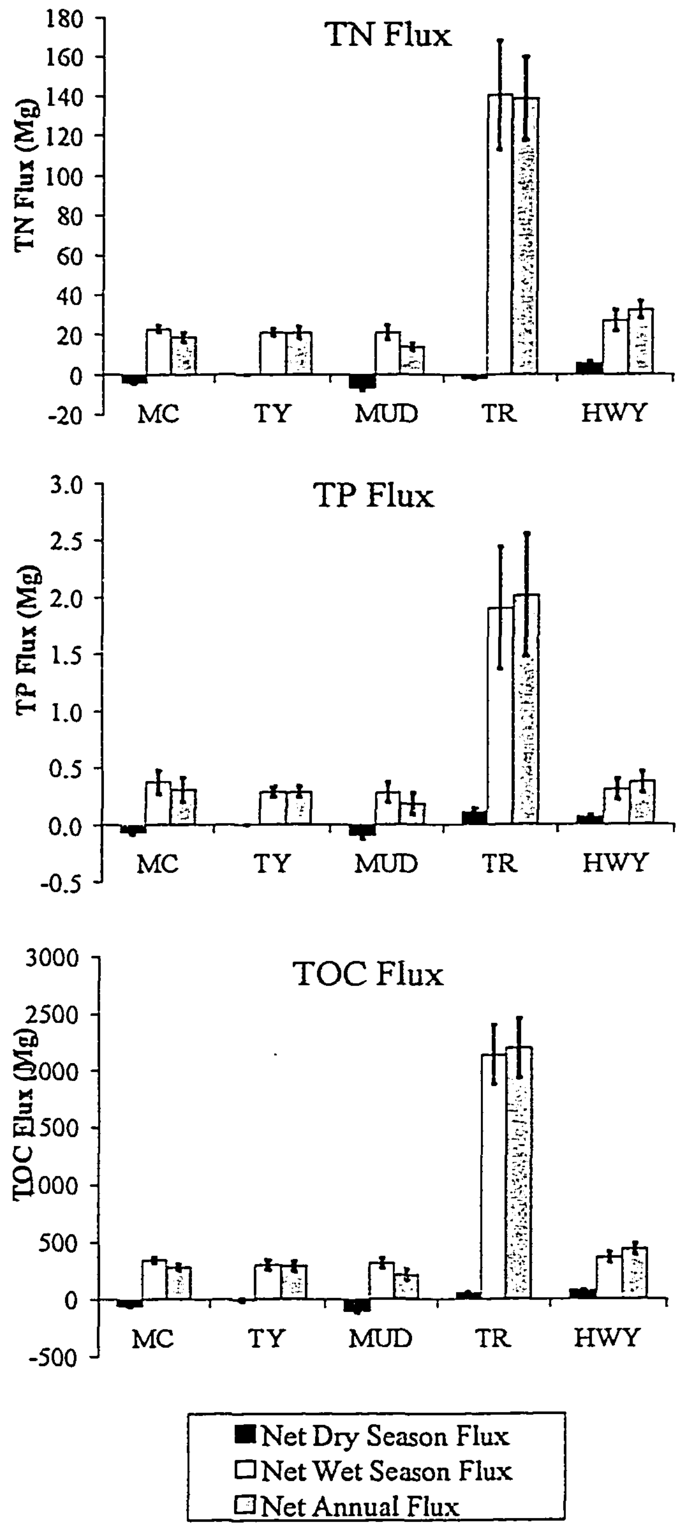

FIGURE 3.7 Net seasonal and annual flux of TN, TP, and TOC from the five creeks for December 1996 – November 1997. Negative flux is an import into the wetland. Error bars indicate absolute error. Abbreviations are as follows: MC = McCormick Creek, TY = Taylor River, MUD = Mud Creek, TR = Trout Creek, HWY = W. Highway Creek.

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area of mangrove wetlands. Resuspended sediments are transported into creek during southerly wind events, then resedimented as water velocity is reduced in the dwarf mangrove forests (Wolanski, 1995; Wolanski and Ridd, 1986). Sediment accretion rates measured by Pb-210 activity in the Taylor Slough/C-111 basin show rates of 0.01 - 0.02 g cm^{-2} yr^{-1} in the mangrove wetlands compared to rates of 0.004 - 0.009 g cm^{-2} yr^{-1} in the freshwater marsh (C. Holmes, personal communication). Higher sediment accretion rates in the salinity transition zone are consistent with sedimentation processes in Gulf of Mexico estuarine wetlands, where winter cold fronts, tropical storms, and hurricanes are a major mechanism for sediment transport into coastal marshes (Baumann et al., 1984; Leonard et al., 1995; Reed, 1989; Rejmanek et al., 1988).

3.4.4 Astronomical Tide

Forcing from astronomical tide on water and material exchange increased to the west, but generally was not a significant factor compared with freshwater and wind. These results are consistent with the work of Wang et al. (1994) showing that tidal influence diminishes in the northeastern basin of Florida Bay due to dampening effect of islands and mudbanks. In Laguna Madre, Texas, limited tidal exchange and shallow water depth is also the reason given for the dominance of meteorological over astronomical tide (Solis and Powell, 1998). The results of our study are an extreme contrast to the majority of flux studies where tidal forcing is presented as the dominant hydrological factor influencing estuarine exchange (Childers et al., 1993). Our work and previous studies have demonstrated that variation in material exchange from major flux events occurs at time scales greater than the tidal cycle (on the order of 10-18 days, Kjerfve et al., 1978; Leonard et al., 1995). These results stress the importance of

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considering exogenous forcing when quantifying exchange in coastal wetlands. Thus, how the location for the flux study is chosen, and the extrapolations made to calculate a representative estimate of flux may lead to erroneous conclusions if spatial gradients and temporal variation in exogenous forcing are not considered.

3.4.5 Annual Flux Estimates

We believe that our predicted estimate of annual TOC, TP, and TN flux in Trout and McCormick using regression equations is reasonable, because we were able to validate these models with independent observations. The close agreement between annual Taylor TN and TP flux predicted from the model versus observed is another validation of our methodology. There are two factors that greatly contribute to the uncertainty in our estimate of annual C, N, and P flux from the Taylor Slough/C-111 basin. First is the lack of concentration measurements in Mud and W. Highway Creeks leads to uncertainty in their estimates. Mud Creek's contribution was small, but West Highway water flux accounted for 15% of the total. However, the observed concentration gradients in the eastern basin were minor, particularly with respect to P (see Chapter 2). Therefore we believe that our extrapolation of Trout and Taylor regression equations for W. Highway and Mud Creek estimates is defendable. Second, error in the estimation of creek discharge can occur during the rainy season, when, in extreme high-water conditions, significant sheetflow can also occur through low-lying mangrove areas between the streams. In addition, there may be other small intermittent creeks that discharge to Florida Bay. The combination of these two factors would lead to an underestimation of our annual flux estimate. Nevertheless, we believe these errors are

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negligible, and our numbers represent a reasonable estimate of N, P, and C export to Florida Bay.

3.4.6 Comparison of Annual TOC, TN, and TP Exchange with Other Estuarine Systems

We compared our annual flux estimates with those of 16 other studies of exchange between estuarine subbasins (Table 3.9). This category of flux measurement is differentiated from studies of wetland-water column exchanges (e.g., Childers and Day, 1990b) and estuarine-coastal ocean exchanges (Dame et al., 1986). Of these 15 studies, two were conducted in a tropical mangrove-dominated tidal creek (Boto and Bunt, 1981; Twilley, 1995; Boto and Wellington, 1988), while the rest were in temperate estuaries. Flux estimates from the Taylor Slough/C-111 basin represent an integration of processes in both mangrove and freshwater marsh, and therefore should be compared with caution to other studies conducted in mangrove forests with little freshwater influence.

Our annual flux estimates from the Taylor Slough/C-111 basin differed from other studies by the 3-4 order of magnitude lower flux of TP and SRP flux than those reported (Table 3.9). DIN, TN and TOC flux were also low, particularly in comparison with studies from other riverine-dominated systems. This general pattern of low net organic carbon and nutrient flux from the SE Everglades is indicative of a wetland ecosystem in the later stages of development. Ecosystems in their early stages import nutrients and accumulate organic matter and biomass, while those in their later stages of development should be at near equilibrium and show little net nutrient flux (Dame et al., 1992; Hopkinson, 1992; Odum, 1969; Vitousek and Reiners, 1975). Superimposed on this is the severe P limitation of this environment (Amador et al., 1992; Koch and Reddy, 1992). Thus the extremely low flux of TP from the SE Everglades is a reflection of the

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Table 3.9. Comparison of annual C, N and P flux estimates from published studies in estuarine subsystems. Positive numbers signify export. Dissolved inorganic fluxes designated by an asterick are a rough estimation calculated from percent dissolved inorganic to total nutrient concentration.

Flux Study	REFS	Climate	Tidal Range	Subbasin Area (ha)	Basin Type	Net Annual Flux (g/m2/yr) NH4	NN	TN	SRP	TP	POC	DOC
Southern Everglades, Florida, USA	this study	subtrop	<0.1 m	48,400	riverine	0.02*	0.013*	0.53	0.0008*	0.007	(TOC=9.5)	
Rhode R. low marsh, Maryland USA	10	temp.	0.3 m	0.18	tidal	1.2	-0.84		0.68		(TOC=1.8)	
Mira estuary, Portugal	1,9	temp.	3.4 m	1.5	riverine	-0.5	-3.8	TDN = 0.3	0.1	TDP = -0.5		188
Rhode R. high marsh, Maryland USA	10	temp.	<0.3 m	3	tidal	0.13	0.06		0.29		(TOC=48.0)	
Crommett Creek, New Hampshire, USA	6	temp.	1 m	4.1	tidal	-2.06	-0.32		-0.56			
Kariega Estuary Marsh, South Africa	14	temp.	?	4.2	tidal						-3	-13
Mont St. Michel Bay, France	1,11	temp.	12 m	5.7	tidal	4	31.6	TDN = 52.8		TDP = 12.2	-15.9	74
Browns Marsh, South Carolina, USA	12	temp.	0.5 m	8.6	riverine	5.7	-8.4					57.3
North River, Massachusetts, USA	3	temp.	1 m	22.8	riverine	-1.41	-10.6					
Blackwater estuary, England	1	temp.	4.3 m	38.5	tidal	-39	54		- 2.2			
Bly Creek, South Carolina, USA	7	temp.	1.7 m	66	tidal	0.54	-0.27		0.3		-31	250
Canary Creek, Delaware, USA	13	temp.	1.3 m	190	tidal						55	104
Coon Creek Marsh, Texas, USA	2	temp.	0.3 m	270	tidal						(TOC=25.6)	
Ems-Dollard, The Netherlands	8	temp.	3 m	980	tidal	1.3	-3.9		0.28		-140	15
Coral Creek, Australia	4,5	trop.	1.5 m	500	tidal	-0.15	0.03	TDN = -1.4	-0.13	TDP = -0.5	332	-7.3
Rookery Bay, Florida, USA	15	sub-trop.	0.5 m	?	tidal						(TOC=16-19)	

Citations:

1. Boorman et al., 1994
2. Borey et al., 1983
3. Bowden et al., 1991
4. Boto and Bunt, 1981
5. Boto and Wellington, 1988
6. Daly and Mathieson, 1981
7. Dame et al., 1991
8. Dankers et al., 1984
9. de Bettencourt et al., 1994
10. Jordan et al., 1983
11. Lefeuvre et al., 1994
12. McKellar et al., 1996
13. Roman and Daiber, 1989
14. Taylor and Allanson, 1995
15. Twilley, 1985

efficiency of this ecosystem in conserving and recycling this nutrient to support biological productivity (Twilley, 1997).

3.4.7 Effects of Increased Freshwater Flow on Nutrient Loading and Potential Impacts on Trophic State of Florida Bay

Capturing the large increase in surface freshwater input in the second year of our study was fortuitous, because it allowed us to observed how nutrient flux from one creek was affected by increased freshwater flow. Taylor River loading of TN and TP to Florida Bay increased 60% and 96% respectively from the previous year. It is important to note that increase in flux was not proportional to the increase in flow. The flow-weighted mean concentration of these constituents decreased 50% for TN and 14% for TP, indicating a dilution occurred with increased freshwater flow.

There are several lines of evidence indicating that, while the hydrological restoration of the southern Everglades will result in increased nutrient transport to the Florida Bay, it will not likely result in increased eutrophication. First, our annual estimates of TN and TP export to Florida Bay support the findings of Rudnick et al. (in press) that nutrient runoff from the southern Everglades represent only 2% of N inputs, and less than 1% of P input to Florida Bay. Second, the material exported to southern Everglades has a mean TN:TP ratio of 170:1, which is much larger than the bay-wide average of 116:1 (Boyer et al., 1997). Fourqurean et al. (1993) suggested that the high N:P ratio of freshwater inflow is one of the factors responsible maintaining P limitation in Florida Bay. In addition, approximately 85% of the nutrients exported is in dissolved organic form (see Chapter 2), so surface freshwater input to Florida Bay is depleted in inorganic nutrients relative to the more refractory organic pool. Third, despite the

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increased loading that may result from restoration efforts, ambient nutrient concentrations in the bay will not increase unless there is a significant gradient in concentration between SE Everglades surface waters and the Bay. Mean TN and TP concentrations in creek surface water (Table 3.8) are the same or slightly higher than for eastern Florida Bay (55 and 0.30 μM), and lower than the bay-wide average (750 μM, Boyer et al., 1997). Assuming that nutrient concentrations in canal inputs to the Everglades do not increase in the future, then increasing freshwater flow will not significantly increase ambient nutrient concentrations in Florida Bay. For these reasons, we have determined that the impact of hydrologic restoration of the southern Everglades on increasing eutrophication of Florida Bay will likely be minimal.

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CHAPTER 4

HYDROLOGIC AND NUTRIENT BUDGETS OF SOUTHEASTERN EVERGLADES WETLANDS

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4.1 INTRODUCTION

The coupling of wetlands with adjacent aquatic ecosystems provides a source of materials for new production within the wetland, and energy subsidies from wetland to the adjacent ecosystems (Odum, 1971; Odum and Heald, 1972). Inputs of allochthonous materials to wetland ecosystems can occur via geologic and biologic pathways, though hydrologic sources usually dominate (Likens et al., 1977). Understanding hydrology is key to discerning what controls the productivity, organic matter accumulation, nutrient cycling and transport within a wetland ecosystem.

Wetland water and chemical budgets are a useful method to assess the relative importance of the various pathways of allochthonous inputs compared to intrasystem recycling in controlling wetland productivity (Mitsch and Gosselink, 1993). They also clarify information gaps required to understand ecosystem function. Despite their utility, there are few coastal wetland water or chemical budgets in the literature, in part because of the extensive data required for their construction (e.g., Boynton et al., 1995). We calculated the water and nutrient budgets for the Taylor Slough/C-111 basin wetlands of the SE Everglades, Florida.

The Everglades is a unique wetland ecosystem in North America due to its carbonate sedimentary environment and sub-tropical climate (Davis, 1940; Lugo and Snedaker, 1974; Light and Dineen, 1994). Phosphorus (P) is the limiting macronutrient in this oligotrophic system, due to the strong affinity of carbonate minerals for P (de Kanel and Morse, 1978). Its availability and distribution strongly control productivity of the Everglades freshwater wetlands (Craft et al., 1995) and mangrove forests (Koch, 1996). The degradation of the Everglades and the adjacent Florida Bay ecosystems has been

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attributed to changes in watershed land use over the past century (Boesch et al., 1993; Light and Dineen, 1994). These activities have resulted in wetland loss, increased nutrient inputs, and diversion of freshwater to the Atlantic coast by canals. Hydrological restoration of the southern Everglades, which began in October 1997, will increase freshwater flow to these wetlands, and ultimately, to Florida Bay (SFWMD, 1990). These restoration efforts will result in increased overland flow to the Bay from the removal of the drainage canal levees and the diversion of freshwater from these canals to Taylor Slough. Evaluating the relative importance of upland, freshwater inputs on the hydrologic and nutrient budgets of SE Everglades will allow us to better understand the effect of restoration activities on wetland productivity and nutrient transport through this landscape.

Atmospheric deposition is an important source of nutrients to oligotrophic ecosystems (Cole et al., 1990; Jassby et al., 1995; Prospero et al., 1996). In the Everglades, there are several factors that point to the importance of atmospheric deposition as a source of P. First, Everglades wetlands in general are very shallow with ambient total P levels at or below 10 μg/L (McCormick et al., 1996). Thus, atmospheric deposition of even low levels of P can provide an important subsidy of this limiting nutrient. Second, the climatic conditions of south Florida are ideal for the dry and wet deposition of P. Dry deposition of aerosol P, which is derived from resuspended agricultural soils, phoso-gypsum mining activities, urban emissions, and long-range transport of dust, has been estimated to comprise as much as 30-50% of bulk P deposition in Florida (Landing, 1997; Meyers and Lindberg, 1997). Rainfall can also scavenge aerosol P. During the summertime, high evaporative rates from the Everglades in

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combination with the convergence of seabreezes and prevailing winds produce daily convective thunderstorms with heavy rainfall. These thunderstorms can reach into the troposphere, scavenging dust and solublizing constituents such as gaseous mercury or ammonia. This mechanism has been implicated in the high concentrations of dissolved mercury found in Florida rainfall (Polman et al., 1995). Therefore, it is likely that the high frequency of convection thunderstorms plays an important role in the deposition of atmospheric P to these wetlands.

Groundwater seepage can also be an important source of water and nutrients to wetlands. Groundwater inputs are a significant portion of the N budget of Massachusetts salt marshes (Valiela and Teal, 1979; Valiela et al., 1978). Groundwater flow is suspected to play a major role in the hydrologic budget of Southern Everglades wetlands because the porous nature of the limestone bedrock enhances hydraulic conductivity (Fennema et al., 1994). Despite the importance of this flow, our understanding of wetland-groundwater interactions and their contribution to the nutrient budget of the Everglades is limited. Based on simulations using the Natural Systems model, Fennema et al. (1994) concluded that the southern Everglades is an important source of groundwater recharge to the Biscayne Aquifer, the main source of water to the lower east coast of Florida. Estimates based on natural chemical tracers and seepage measurements in Florida Bay suggest that submarine groundwater seepage may provide as much N and P as surface water runoff from the Everglades (R. Corbett, personal communication).

The work presented here is a preliminary assessment of the seasonal and annual water and nutrient budgets of the Taylor Slough/C-111 basin wetlands. We used these budgets to understand the relative importance of atmospheric deposition versus surface

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water and groundwater inputs as sources of nutrients to these wetlands. In addition, we assessed the magnitude of these source and loss terms versus literature values for sediment N and P burial, N fixation, and denitrification in this basin. Nutrient budgets calculated for a northern Everglades constructed freshwater wetland receiving agricultural runoff showed that atmospheric deposition accounted for 7% of TN and 3% of TP inputs (Moustafa et al., 1995). Brezonik and Shannon (1971) found that atmospheric deposition accounted for between 29 and 59% of the P budgets of northern and central Florida lakes. We hypothesized that in the relatively pristine SE Everglades wetlands, atmospheric deposition is a more important P source than surface freshwater input because the canal water nutrient concentrations are generally < 10 μg/L. To address this hypothesis, we evaluated the seasonal and annual water, N and P budgets for these wetlands.

4.2 METHODS

4.2.1 Study Area

The freshwater and mangrove wetlands of the SE Everglades are located at the southern-most extent of the Florida peninsula, and border Florida Bay, a large, shallow, sub-tropical embayment bounded on the south and east by the Florida Keys (Fig. 4.1). The study area, approximately 457 km^2 in size, is comprised of two sub-basins, Taylor Slough and the wetland area south of the C-111 canal. This area will be referred as the Taylor Slough/C-111 basin. Taylor Slough historically was the major conduit for freshwater flow to Florida Bay (McIvor et al., 1994). During the past century, surface water flow into the slough was drastically reduced, so that currently the major upland

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flows into this system are anthropogenically-controlled inputs from a series of canals (Fig. 4.1). Taylor Slough's western boundary is a slightly elevated ridge that delineates

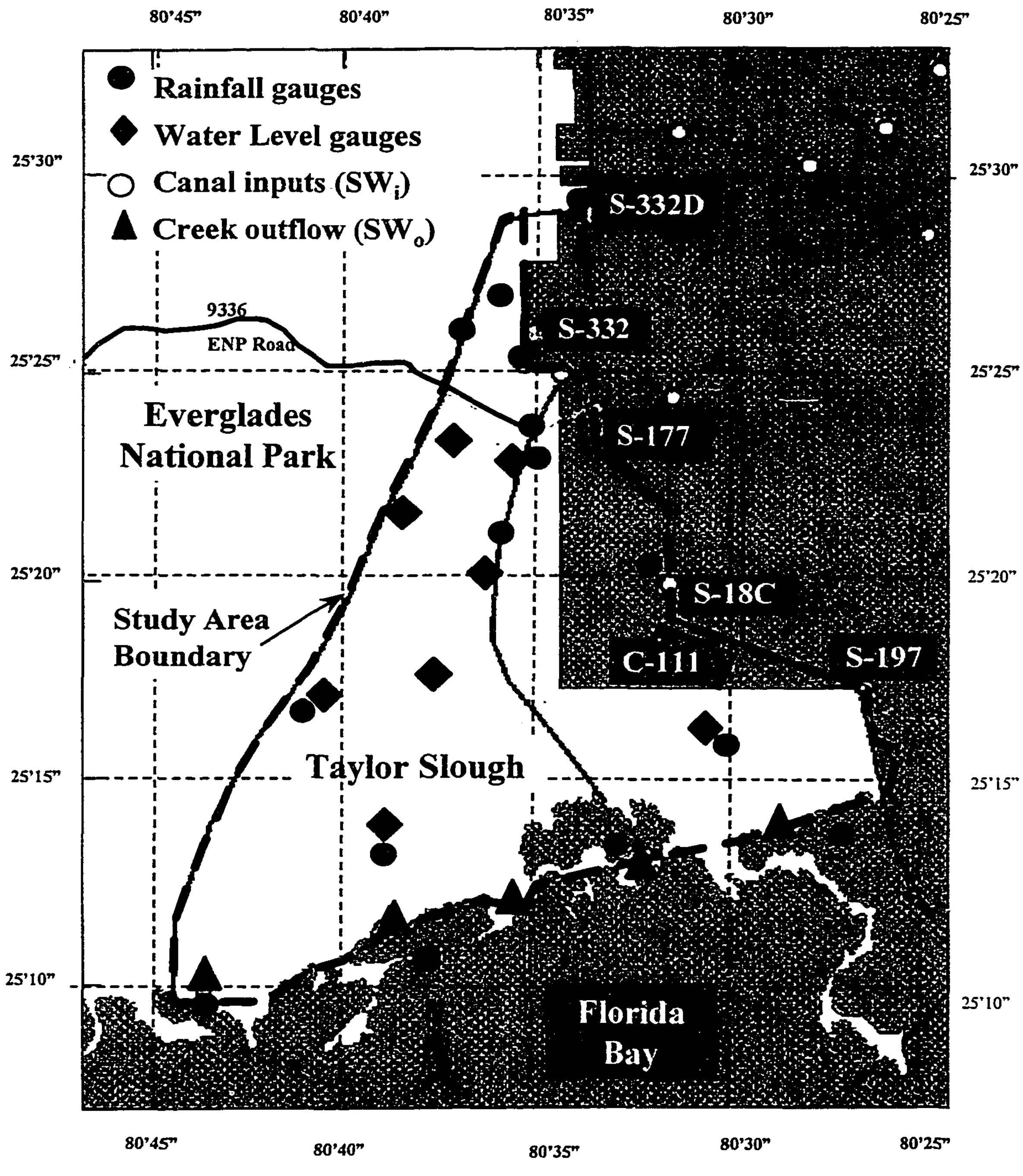

FIGURE 4.1 Location of Taylor Slough/C-111 basin in SE Everglades, Florida

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it from Shark River Slough. The southern levee from the C-111 canal has been partially removed as part of restoration efforts in the SE Everglades. As a result, water flows into wetlands south of the C-111 canal towards Florida Bay. As surface water from Taylor Slough and the C-111 canal flows south towards the bay, it becomes increasingly channelized, and drains into five major creek systems that discharge to Florida Bay. At the wetland-bay interface, the creeks cut through an area of relatively high topographical relief called the "Buttonwood Ridge." This ridge restricts the overland flow of water, making the five creeks major point source inputs of freshwater to Florida Bay. The climate of Florida Bay and the southern Everglades is characterized as sub-tropical savanna with distinct rainy and dry seasons (Hela, 1952). The wet season extends from June through November, while the dry season is December through May (Jordan, 1984). While wet season precipitation is produced primarily by daily convection thunderstorms, less frequent tropical storms and hurricanes can also contribute significant amounts of rainfall in short time periods (Chen and Gerber, 1990). The dry season has mild temperatures and low precipitation, with periods of sporadic rainfall and low temperatures associated with the weekly passage of winter cold fronts (primarily November through March, Chen and Gerber, 1990).

4.2.2 Water Budget

Seasonal and annual water budgets for the Taylor Slough/C-111 basin wetlands were calculated for the time period of June 1996 through December 1997. This time period captured two rainy seasons and one dry season. The sources and sinks of water for a given region are given in Eq. 1:

$$GW_i + SW_i + P - GW_o - SW_o - ET \pm \Delta S = 0 \quad \text{Eq. 1}$$

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where GW_i and GW_o are the groundwater input and output terms, SW_i and SW_o are the surface water input and output terms, P is precipitation; ET is evapotranspiration; and ΔS is the change in storage. The assumptions and the methodology used to derive each term and its error are given below.

Surface water inputs to the Taylor Slough/C-111 basin (SW_i) are anthropogenically controlled inputs from the L31W in northern Taylor Slough and from the C-111 canal to the east. Studies of surface water flow have shown that overland flow from west is negligible (E. Swain, personal communication). Surface water inputs from canals (SW_i) was assumed to be the sum of the discharge from the S332, S175, and S18C water management control structures minus the discharge from the S197, which when open discharges to Biscayne Bay. Error in estimated discharge from the four water control structures ranged 13 - 31% (A. Alexis, personal communication). This estimate of surface water input to Taylor Slough/C-111 basin is likely to be a maximum value, since flow may be returning back to canals via local groundwater flow.

Overland flow to Florida Bay is negligible. The Buttonwood ridge restricts overland flow from the Taylor Slough/C-111 wetlands to Florida Bay, thus confining most of the flow to several creeks that cut through the ridge. Since 1996, USGS has measured the discharge of the five major creeks that drain the Taylor Slough/C-111 basin. These include Taylor River, McCormick, Trout, Mud, and West Highway Creeks (Fig. 4.1). Surface water output (SW_o) was assumed to be the sum of the daily discharge of these five creeks. Daily relative error associated with measurement of surface water outputs from the five creeks averaged 5% (E. Patino, personal communication).

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Inputs to water budget from precipitation were calculated from daily rainfall data from 15 gauges in the study area. These gauges are not evenly distributed, so the precipitation data were area-weighted using the Thiessen polygon method (Watson and Burnett, 1995). The precipitation estimate was multiplied by the surface area of the basin to arrive at a volume input. A major source of variability in precipitation estimates arises from the spatial variability in rainfall. This error decreases with the length of the time period for which precipitation is estimated (Winter, 1982). Gauge density in this study was 30 km^2/gauge. Monthly sampling error with a gauge density of 60-120 km^2/guage ranged 4-6%. Based on this work, we assumed error in our estimate would be 5%.

Actual evapotranspiration (ET) was measured by USGS using the Bowen ratio method (Tanner, 1960) for the time period of January 1996 through December 1997. The average annual ET rate for this time period was estimated as 120 cm yr^{-1} with an error of 10% (E. German, personal communication). However, at the time of this study the USGS daily ET time series data was not yet available on the public record, and we were interested in estimating seasonal ET rates. Therefore, we also calculated daily potential ET with the Penman equation, using data from a meteorological station located within the basin (Penman, 1948). By our calculations, potential ET calculated with the Penman equation under-predicts ET measured with the Bowen ratio method by 35%. To correct the calculated potential ET rate to the USGS measured actual ET, we multiplied the daily potential ET by a correction factor of 1.35 to yield an annual ET rate of 120 cm yr^{-1}. The ET estimate was multiplied by the surface area of the wetland to arrive at a volume output. Error in this estimate was assumed to be 10%.

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Change in storage (ΔS) was calculated as the average change in daily mean water level at eight locations in the study area over the time period of interest, multiplied by the surface area of the basin. Error of this value was assumed to be the standard error the eight estimates of water level change.

Net groundwater contribution to the budget (GW_i - GW_o) was estimated as the difference between input, output, and storage terms in Eq. 1. Error in this estimate ($E(GW_i - GW_o)$) was the propagation of error estimates of other terms in the equation, given by Eq. 2.

$$E(GW_i - GW_o) = [E(P)^2 + E(ET)^2 + E(SW_i)^2 + E(SW_o)^2 + E(\Delta S)^2]^{0.5} \qquad \text{Eq. 2}$$

4.2.3 Nutrient Budget

The total nitrogen (N) and total phosphorus (P) budgets for the Taylor Slough/C-111 basin were calculated as the contribution of each nutrient from each of the terms in the water budget, as given by equations 4 and 5.

$$N(GW_i - GW_o) + N(SW_i) + N(P) - N(SW_o) \pm N(\Delta S) = N(Res) \qquad \text{Eq. 3}$$

$$P(GW_i - GW_o) + P(SW_i) + P(P) - P(SW_o) \pm P(\Delta S) = P(Res) \qquad \text{Eq. 4}$$

where N(GW, SW, ΔS, P, ET) and P(GW, SW, ΔS, P, ET) represent the contribution of N and P from each of the water budget terms respectively. N(Res) and P(Res) represent the residual terms for the N and P budgets respectively. Assuming that there is no net loss of N or P over an annual cycle, this residual would be equal to sediment burial of N and P plus other sinks and sources of N from denitrification or N fixation (Boynton et al., 1995).

N and P loading for each water budget term was calculated as the concentration multiplied by volume discharge. Error in TN and TP nutrient flux in surface water

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outflow was 9% and 16% respectively (see Chapter 3). For the remaining terms, error in nutrient concentration was unknown, so the error for each nutrient loading term was calculated from the product of the nutrient concentration and the error for the water budget term. Error in the N(Res) and P(Res) term was propagated from the errors in the other terms as in Eq. 2.

Nutrient concentration in canal inflows (SWi) was determined from monthly monitoring data available from the South Florida Water management DBHYDRO database. Nutrient loading from each water management structure was calculated as the product of the monthly mean nutrient concentration and the daily cumulative water discharge per water management structure. Missing nutrient concentration values for a given structure were estimated by a linear interpolation between the most recent known values. Nutrient loading in surface water outflow (SWo) from the five creeks was estimated in Chapter 3. The analysis of all estuarine and freshwater samples was done with documentation of quality assurance and control procedures. For the freshwater samples analyzed by the South Florida Water management district, TN was digested using the micro-kjeldahl method and TP was digested by wet oxidation with persulfate (Clesceri et al., 1989). Estuarine samples were analyzed for TN using an ANTEK nitrogen analyzer (Jones and Frankovitch, in press); TP was digested as in Solorzano and Sharp (1980).

We chose rates of atmospheric TN and TP deposition based on data available from the National Atmospheric Deposition Program (NADP) and published values for the ENP and the Florida Keys. The NADP 1996 estimate of DIN at the Everglades National Park site (F-11) is 0.32 g N $m^{-2}yr^{-1}$ (NADP, 1999). This is close to that reported

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for the same site in 1990 (0.31 g N $m^{-2}yr^{-1}$, Prospero et al., 1996). Hendry et al. (1981) reported that TN deposition was 1.45 times that of DIN for a site near Key West in 1978 and 1979. Based on this assessment, we multiplied the DIN deposition rate measured at the NADP-F11 site by a factor of 1.45 to derive a bulk TN deposition rate of 0.46 g N $m^{-2}yr^{-1}$. Atmospheric deposition of P is particularly difficult to quantify due to persistent sample contamination and limitations in sampling methods (Redfield, 1998). The measured rates of bulk atmospheric P deposition in the Everglades have ranged from 0.017 – 0.07 g P $m^{-2}yr^{-1}$, with an average of 0.03 P $m^{-2}yr^{-1}$ (Redfield, 1998). A low estimate of 0.006 g P $m^{-2}yr^{-1}$ was found for the Bahamas (Graham and Duce, 1982). Based on this review, we cautiously chose an intermediate bulk TP deposition rate of 0.02 g P $m^{-2}yr^{-1}$.

Groundwater nutrient concentration and the nutrient loading or loss resulting from storage change were the two unknown quantities. We assumed that groundwater nutrient concentrations would be similar to that of surface water in the study area, and therefore that daily groundwater nutrient concentration is equivalent to the daily flow-weighted mean TN and TP concentration in surface water outflow. To calculate the change in nutrient loading from ΔS, we assumed: 1. the daily flow-weighted mean concentration of TN and TP in surface water outflow (SWo) was equivalent to the daily concentrations in the surface water of the study area; and 2. the change in TN and TP concentration from the beginning to the end of the time period was negligible. Therefore, the change in nutrient loading resulting from ΔS was calculated as the product of ΔS and the flow-weighted mean concentration of TN or TP in SWo for that time period.

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4.3 RESULTS

4.3.1 Water Budget

Analysis of monthly precipitation, ET, and surface inflow and outflow during June 1996 to December 1997 illustrates a distinct pattern associated with wet and dry season meteorological forcing (Fig. 4.2). Approximately 75% of the 138 cm in mean annual precipitation fell during the rainy season. ET rates peaked during the summer months, and were lowest during the winter. Monthly precipitation patterns are well correlated to patterns of surface water inflow and outflow in the study area ($R^2 = 0.49$), indicating that precipitation is largely responsible for patterns seen in surface water flow through the Everglades. During the rainy season, precipitation was slightly higher than ET, resulting in a positive water balance for most rainy season months (Fig. 4.2). Net atmospheric water balance during the dry season was negative (-65 cm), when ET exceeded precipitation by a factor of two. On an annual basis, the atmospheric water balance was not significantly different from zero (-16 ± 23 cm yr^{-1}).

Precipitation was more important than surface water inflow to the seasonal and annual water budgets of the Taylor Slough/C-111 basin. Precipitation exceeded canal inputs by a factor of 1.5 during the rainy season, and by a factor of 5 during the dry season (Fig. 4.3). Annually and during both rainy seasons, surface water inflow balanced outflow. During the dry season, surface water inflow was small, and there was a net flow of water from Florida Bay to the wetlands (Figs. 4.2-4.3).

Storage changes were negligible relative to other water budget terms both annually and during the rainy season. In the dry season, ΔS was comparable to surface water inflow and outflow, but smaller than precipitation, ET, and the residual

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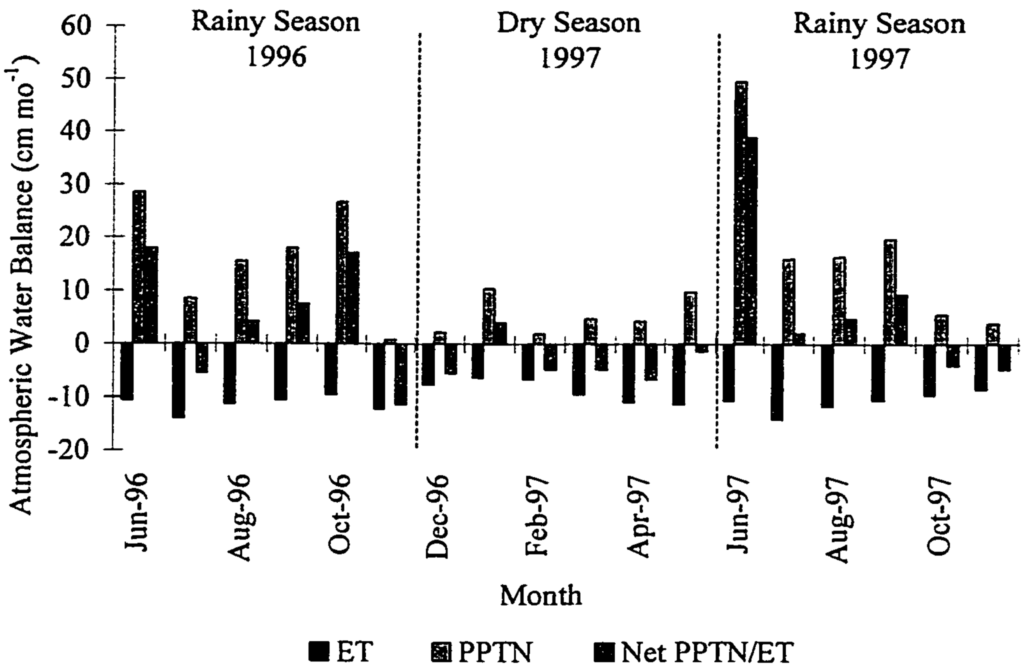

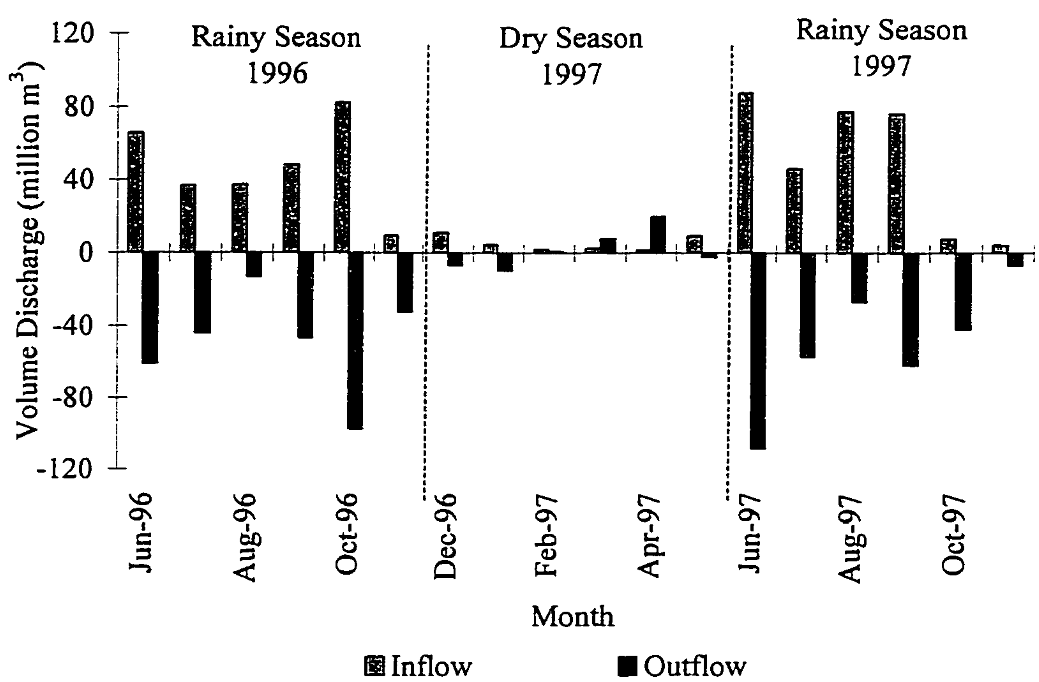

FIGURE 4.2 Taylor Slough/C-111 basin monthly atmospheric water balance and surface water inflow and outflow for period of June 1, 1996 – November 30, 1997. Positive and negative value indicates water input and loss from system respectively. Abbreviations are as follows: ET = evapotranspiration; PPTN = precipitation; Net PPTN/ET = net sum of precipitation minus evapotranspiration.

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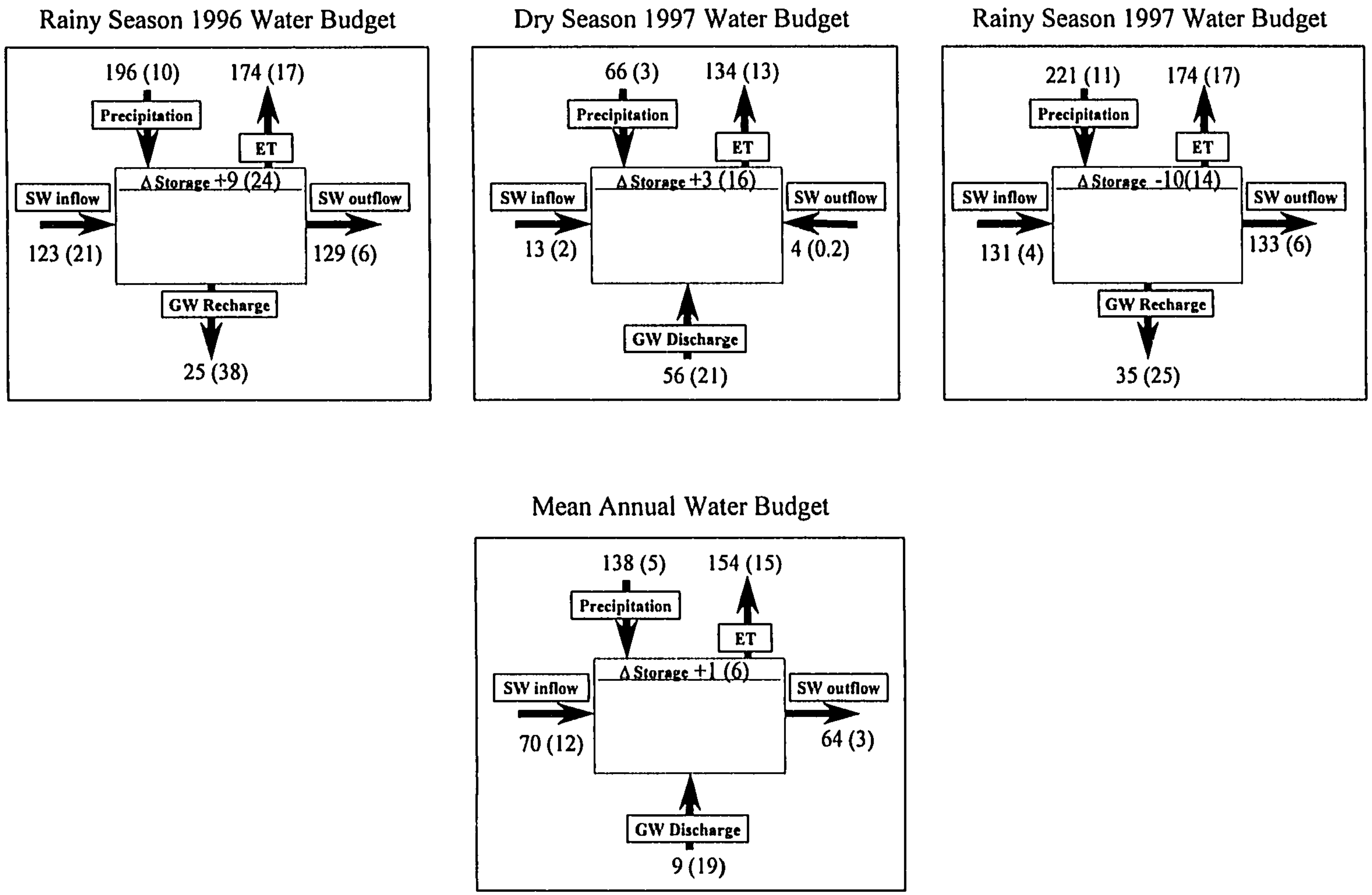

FIGURE 4.3 Taylor Slough/C-111 basin seasonal and mean annual water budgets. All values are in cm yr^{-1}. Absolute error estimates are in parentheses. Direction of arrow indicates flow direction. Values in parentheses indicate absolute error. A negative change in storage is a loss to system. Mean annual budget represents the average of values for June 1, 1996 – May 31, 1997 and December 1, 1996- November 30, 1997.

groundwater term. The high error estimate relative to average ΔS indicates high variability in water level changes among the eight stations.

The rainy season and mean annual water budgets indicate a balance among ET, precipitation, storage change, and surface water inflow and outflow (Fig. 4.3). Thus, the residual groundwater terms during these periods were insignificant. This was not the case for the dry season budget, where a significant groundwater residual of 47 cm yr^{-1} was required along with surface water inputs and precipitation to balance high evaporative losses.

4.3.2 Nutrient Budget

Atmospheric deposition was the most important input term for the P budget regardless of season, and an important input of N to the Talyor Slough/C-111 basin wetlands during the dry season (Figs 4.4-4.5). Atmospheric deposition exceeded P loading from surface water inputs by a factor of 3-4 during the wet season, and by a factor of 9 during dry season. Annually, the contribution of N from surface water inflow was roughly equal to that of atmospheric deposition. However, on a seasonal basis, the relative importance of these two terms changed. Surface water input of TN was 50% greater than atmospheric deposition during the rainy season, but one half the input of atmospheric deposition during the dry season.

On an annual basis, net groundwater flux was an insignificant source of N and P to the budget of SE Everglades wetlands. However, during the dry season the net groundwater discharge into the study area was the most important hydrologic input of N into the basin (Fig. 4.4). Groundwater discharge was also an important source of P during this season, contributing 32% of the total P inputs to the wetland (Fig. 4.5). The

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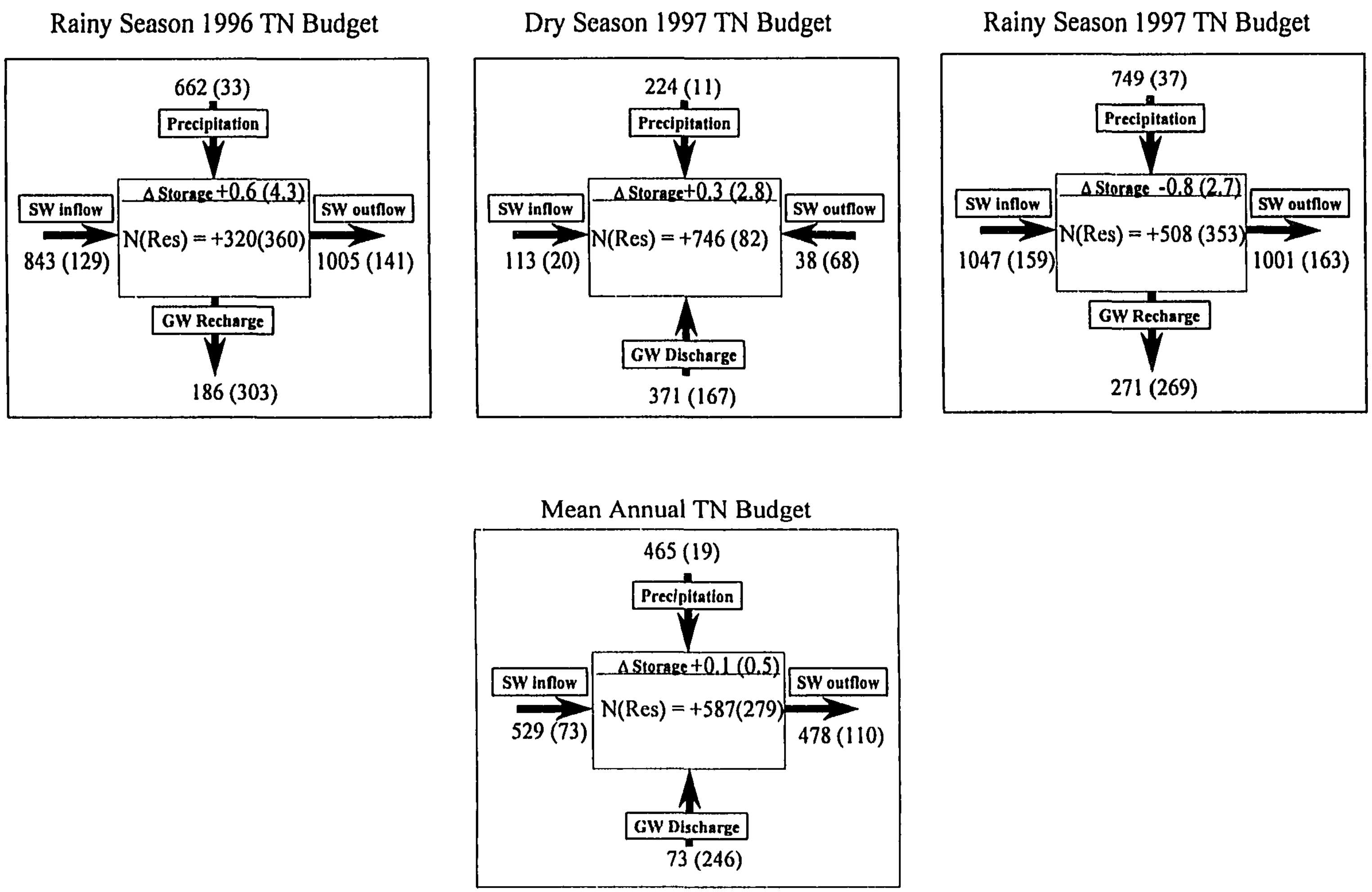

FIGURE 4.4 Taylor Slough/C-111 basin seasonal and mean annual N budgets. All values are in mg N m^{-2} yr^{-1}. N(Res) represents the sum of N inputs minus losses. Direction of arrow indicates flow direction. Values in parentheses indicate absolute error. A negative change in storage is a loss to system. Mean annual budget represents the average of values for June 1, 1996 – May 31, 1997 and December 1, 1996- November 30, 1997.

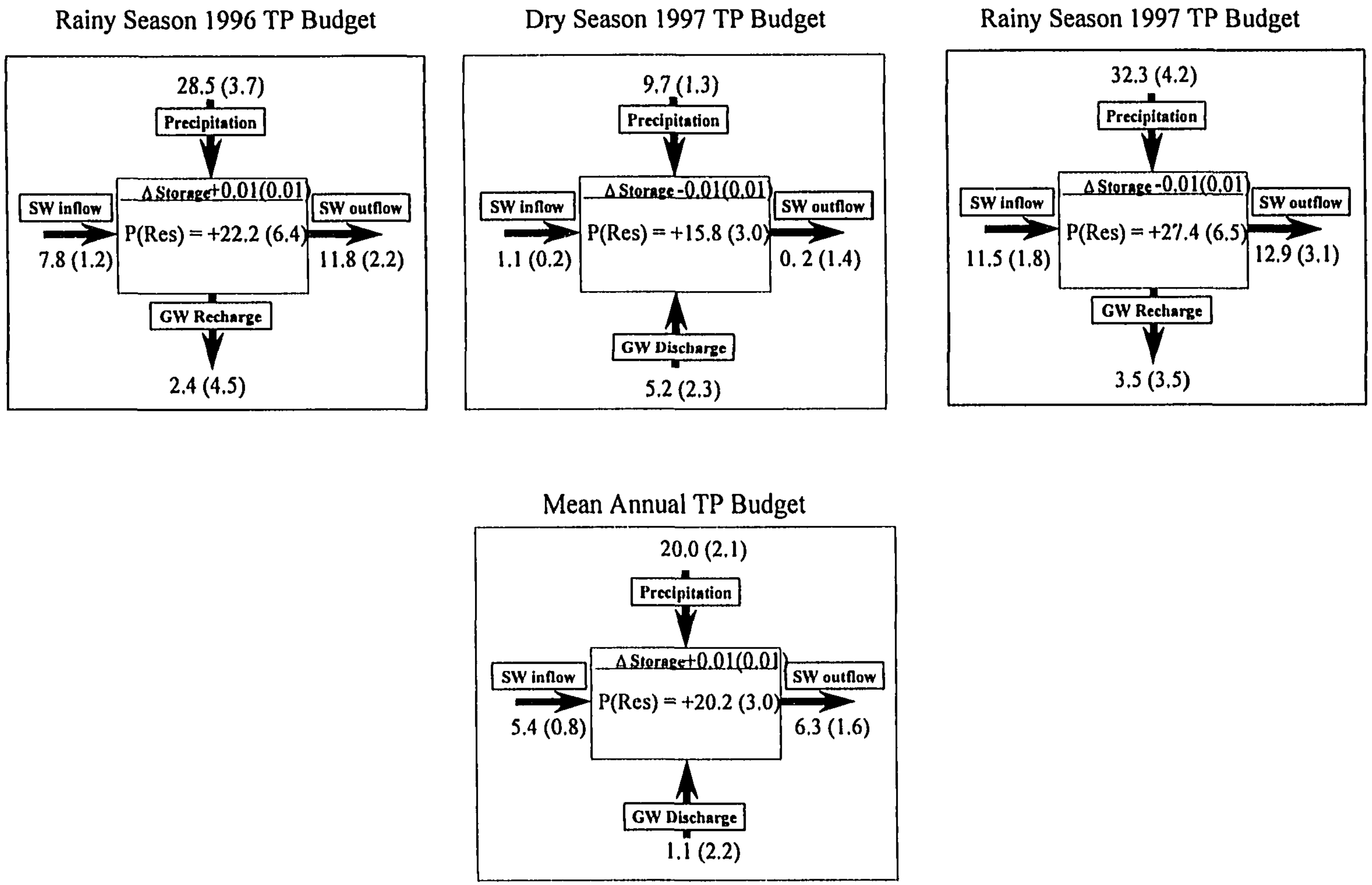

FIGURE 4.5. Taylor Slough/C-111 basin seasonal and mean annual P budgets. All values are in mg P m^{-2} yr^{-1}. P(Res) represents the sum of P inputs minus losses. Direction of arrow indicates flow direction. Values in parentheses indicate absolute error. A negative change in storage is a loss to system. Mean annual budget represents the average of values for June 1, 1996 – May 31, 1997 and December 1, 1996- November 30, 1997.

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sum of the nutrient source and loss terms yielded a positive residual for each season, indicating a net import of N and P into the wetland from allochthonous sources (Figs. 4.5-4.6). Surface water export of N and P generally balanced that of canal inputs, and the contribution of the change in storage term to the N and P budgets was negligible. Therefore, the balance of the atmospheric deposition and groundwater discharge or recharge term determined the residual N and P calculated for the budget. The high input of atmospheric P was largely responsible for the significant net import of P during both the rainy and dry seasons, with rainy season import 50% higher during the dry season.

Over an annual cycle, net P import was 20 +/- 4 mg $m^{-2}yr^{-1}$. There was consistent net import of N during both the rainy season and dry seasons, though during the 1996 rainy season this residual was not significant. During the dry season, the positive N residual was driven by the combined inputs of atmospheric deposition and groundwater discharge. Annually, N inputs from groundwater discharge was insignificant, so the positive N residual of 590 +/- 296 mg $m^{-2}yr^{-1}$ was driven by the value for atmospheric deposition.

4.4 DISCUSSION

4.4.1 Relative Importance of Budget Inputs

Atmospheric deposition was the dominant source of water and P to the Taylor Slough/C-111 basin, and on an annual basis, as important as surface water input as a source of N. The importance of atmospheric P on budget of SE Everglades wetlands differed from a nutrient-impacted site in northern Everglades (Moustafa et al., 1995). In the latter, surface water input was the major source of P, and atmospheric sources represented less than 9% of total inputs. Over 90% of N and 60% of P measured in the

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surface water draining from the Everglades agricultural area was removed before reaching the canals that discharge into study area (Rudnick et al., in press). Thus, surface freshwater input is comparatively low in nutrient concentration, and atmospheric P deposition assumes a larger role in the wetland budget. The importance of atmospheric deposition in terrestrial oligotrophic ecosystems has been recognized for some time. Over the past decade, awareness of the importance of atmospheric deposition in the budgets of oceanic and coastal waters is increasing (Duce, 1986; Galloway et al., 1996; Paerl, 1995). Fisher and Oppenheimer (1991) found that 39% of the "new" N entering the Chesapeake Bay watershed was attributable to atmospheric deposition. Atmospheric deposition is the major N source in 12 northern Florida watersheds (Fu and Winchester, 1994; Winchester et al., 1995). Higher rates of atmospheric N and P deposition are associated with proximity to urban or industrial areas (Paerl, 1995; Redfield, 1998). The SE Everglades is located within 100 miles of Miami metropolitan area, so increased loading from atmospheric deposition should be considered in the management of these wetlands.

Surface water inflow was a major input of nutrients into the SE Everglades, accounting for 50% of N and 20% of P inputs into the system. The majority of the exchange with surface water occurred during the rainy season. During the dry season, loading from canal inputs is small, and there is a small net inflow of water to the wetland from the Bay. This net inflow results from a combination of wind-driven forcing of bay water into study area and high evaporitic losses, and results in the advection of higher salinity Bay water into the lower Everglades (Sutula, 1999). While nutrient loading in surface water inflow from canals generally balanced outflow to the Bay, there is evidence of wetland uptake and transformation of nutrients advected from surface freshwater input.

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Rudnick et al. (in press) observed a decrease from 11.6 to 6.1 μg P L^{-1} within 3 km of canal discharge to the wetland. While there was no change in TN over this transect, DIN fraction of TN decreased from 26% to less than 5%, while the organic fraction increased. The ecological effect of P and N loading from surface freshwater inflow is probably less important when compared with atmospheric sources. Inorganic nutrients dominate the atmospheric deposition of TN and TP (Hendry et al., 1981), while the more biologically refractory organic pool dominates the canal inputs.

We believe groundwater interactions within the Taylor Slough/C-111 basin are substantial, despite the annual water and nutrient budgets showing an insignificant net groundwater discharge into the basin. The groundwater term represents an estimate of the net sum of groundwater inputs and outputs in the study area (GW_i - GW_o). Thus, while both of these terms may be large, annually and during the rainy season their difference is insignificant. During the dry season, surface water inflow and outflow are very small, so the net groundwater discharge is driven by balance of net precipitation and ET. Intuitively this is reasonable, and there is literature to support the importance of groundwater in this area. First, the Miami Oolite formation, which underlies Taylor Slough and Florida Bay is highly porous. Groundwater flow rates in this formation have been reported as high as 0.30 m hr^{-1} (LaPointe et al., 1990). There is a significant inverse relationship between groundwater level in northern Taylor Slough and salinity at the mouth of Taylor River (r = -89), and between groundwater level at the Homestead Well and salinity in Trout Creek (r = -91; Tabb, 1967). This relationship tended to break down when groundwater levels in the Homestead well were < 0.55 m. The Natural Systems Model, a two-dimensional model of surface and groundwater flow in the Everglades,

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showed that groundwater must be a substantial source of evaporated water during the dry season or in dry years (Fennema et al., 1994). In addition, there is some indirect evidence indicating a groundwater flux between the salt/fresh groundwater interface of Taylor Slough and NE Florida Bay (Swarsenski et al., 1999). It is clear that more research is needed to understand the influence of groundwater on nutrient transport throughout this region.

4.4.2 Net Hydrologic Import of Nutrients Versus Internal Wetland Sources and Losses

Our estimate of net hydrologic import of P is within the same order of magnitude of sediment P burial in SE Everglades wetlands. Our budget calculations show a net annual import of 20 ± 4 mg P m^{-2} yr^{-1} into the Taylor Slough/C-111 basin. This number should be equal to the sediment P burial rate, plus any change in the storage of P from plant standing biomass or fauna. The net annual accumulation of woody biomass in dwarf mangroves is negligible (C. Coronado-Molina, personal communication), and we assumed the annual change in faunal biomass was zero. Sediment P burial rates were calculated from unpublished data in the Taylor Slough freshwater and estuarine wetlands (C. Holmes and W. Orem, personal communication). The net P residual was lower but within the same order of magnitude of preliminary P burial rates estimated for Taylor Slough/C-111 basin (33-71 mg P m^{-2} yr^{-1}, Table 4.1). The difference in the budget residual and estimated sediment burial rate may be attributable to the conservative estimate of atmospheric P deposition or an underestimation of groundwater discharge in the area.

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Table 4.1 Literature values for rates of sediment N and P burial, nitrogen fixation, and denitrification. Sediment burial rates were calculated assuming a mean sediment accretion rate of 0.01 – 0.02 g cm-2 yr-1 in mangrove wetlands, and 0.004 – 0.009 g m-2 yr-1 in freshwater wetlands, and sediment % TN and TP of 3.6 and 0.055% respectively in Taylor Slough mangrove wetlands, and 3.3 and 0.068% for Taylor Slough freshwater wetlands. (* = weighted range for the entire slough is based on an 1:3 ratio of mangrove to freshwater wetlands)

SOURCE OR LOSS TERM	RATE ($MG\ M^{-2}\ YR^{-1}$)	SOURCE
Burial		
Taylor Slough freshwater P	26-58	Calculations based on unpublished values for sediment accretion and % sediment N and P (C. Holmes and W. Orem, personal communication)
Taylor Slough mangrove P	55-110	
Weighted range P*	33-71	
Taylor Slough freshwater N	1320-2970	
Taylor Slough mangrove N	3600-7200	
Weighted range N*	1890-4027	
Denitrification		
Mangroves, Mexico	230-1150	(Rivera-Monroy and Twilley, 1996)
Nitrogen fixation		
Mangroves, Tampa Bay, FL	30 - 2600	(Zuberer and Silver, 1978)
Mangroves, Shark R. Slough, Fl	3000	(Pelegri et al., 1997)
Cypress swamp, Everglades, FL	790 - 2800	(Dierburg and Brezonik, 1981)

Nitrogen cycling in the Everglades has received far less attention than the P cycle (Rudnick et al., in press). Interpreting our N budget results is difficult, due to the relative scarcity of published rates of nitrogen fixation and denitrification rates in the SE Everglades. Our calculations show a net annual import of 590 ± 296 mg N m^{-2} yr^{-1}. Assuming no net annual change in plant and faunal biomass, this residual should be equal to the sum of denitrification and burial minus nitrogen fixation. Sediment N burial, calculated from unpublished data in Taylor Slough (W. Orem, personal communication, Table 1), ranges 1890 - 4027 mg N m^{-2} yr^{-1}. Estimates of nitrogen fixation are available

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for the mangrove wetlands for Shark River Slough and Tampa Bay and for a freshwater cypress dome in the Everglades (Dierburg and Brezonik, 1981; Dierburg and Brezonik, 1983; Pelegri et al., 1997; Zuberer and Silver, 1978). These estimates are highly variable (30 – 3000 mg N m^{-2} yr^{-1}), and are dependent on whether the measurements are made on plant litter, bare soil, or in the root zone (Table 4.1). No estimates of nitrogen fixation have been made in *Cladium* marshes, the dominant emergent macrophyte community in the SE Everglades. Studies of direct and coupled denitrification using ^{15}N tracers have been conducted in mangrove wetland of Yucatan Peninsula, Mexico (Rivera-Monroy and Twilley, 1996). Rivera et al. (1996) found low rates of denitrification (230-1150 mg m^{-2} yr^{-1}), and attributed these results to the low nitrate levels in mangrove wetlands, and to high rates of N immobilization by sediment bacteria due to the high C:N ratio of mangrove leaf litter. Although potential denitrification has been measured in the northern Everglades (Gordon et al., 1986), rates were not available from this study. We assume that denitrification rates in the SE Everglades will be low, due to the low nitrate levels found in these wetlands (approximately 0.03 mg L^{-1}).

The large range in estimates of nitrogen fixation and denitrification rates in SE Everglades makes interpretation of our numbers difficult. However, assuming our estimation of N hydrologic import is reasonable, high rates of sediment N burial can be attributable to either high nitrogen fixation rates or an underestimation of groundwater discharge. The hypothesis that N fixation is driving high sediment burial rates is supported by the observation of increasing sediment N content south in Taylor Slough away from canal inputs (W. Orem, personal communication). Several studies have noted the importance of nitrogen fixation in N budgets of freshwater wetland because of the

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limited allochthonous N inputs (Chapman and Hemond, 1982; Dierburg and Brezonik, 1981; Dierburg and Brezonik, 1983; Howarth et al., 1988). It is likely that N fixation studies cited in Table 4.1 were conducted in areas with higher soil phosphorus content. It is not clear if the P depletion of Everglades soils limits nitrogen fixation. In interpreting these numbers, we must also take into account the high uncertainty associated with our groundwater discharge estimate. We suspect that the estimate is conservative. The calculation of surface water input is a maximum value, while that of surface water output is a minimum value. Thus, error in these two estimates would result in an underestimation of groundwater discharge. Underestimation of groundwater discharge would drive the N and P residual higher, particularly if the groundwater nutrient concentrations are higher than what is found in wetland surface waters. Clearly, more research is required to clarify the role of N fixation versus groundwater flux on the nutrient budgets of these wetlands.

4.4.3 Uncertainty in Water and Nutrient Budgets

The values for the water, N and P budgets of the Taylor Slough/C-111 basin are preliminary estimates, and as such we interpret these numbers with caution. Although these estimates have a high degree of associated uncertainty, we believe the order of magnitude of these estimates is credible, and are fairly representative of SE Everglades water and nutrient budgets during the time period measured. In this section, we comment on how uncertainty in the data and assumptions we used may affect our results.

The contribution of groundwater was the largest uncertainty in the budget, and its estimation affected the magnitude of net N and P residual calculated. The net groundwater residual was most sensitive to errors in precipitation and ET numbers, and to

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a lesser extent by surface water inflow and outflow estimates. The non-significant net value of groundwater flux calculated for this budget is deceiving. A better understanding of local and regional groundwater movement through the area is necessary to clarify the true role of groundwater on the nutrient budgets of this region.

Our estimates of rainfall and ET numbers are reasonable, since both rainfall and ET estimates were derived from direct field measurements during the study period. Atmospheric deposition of DIN was also measured within the study area, but there is uncertainty in the estimates of atmospheric deposition of bulk P and organic N, since these values were derived from literature estimates. The literature values that we chose were conservative, so it is possible that the N and P residuals calculated are larger than originally estimated. While error is inherent in the method in which we calculated change in storage, the contribution of this term to the water and nutrient budgets was minimal, and error in its estimation is not likely to affect our results.

We are fairly confident of the nutrient concentrations used to estimated surface water inflow and outflow, but there is some uncertainty in the quantification of discharge related to these terms. Although TN and TP concentration in canal inputs were measured on a monthly basis, the concentrations are constant, and we believe fairly representative of monthly averages. Nutrient concentrations in three of the five creeks discharging to Florida Bay were measured intensively during a 2.5 year study (see Chapter 3). The estimate of surface water inflow is a maximum value, since it is possible that flow can reenter the canal as groundwater downstream. Error in the estimation of outflow is most likely to occur during the rainy season, when, in extreme high-water conditions, significant sheetflow can also occur through low-lying mangrove areas between the

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streams. The errors in measurement of surface inflow and outflow are most likely to be higher in the rainy season than dry season. These errors would result in an underestimation of groundwater discharge into the wetland, and thus an underestimation of the N and P residual values. During dry season, errors in surface water inflow and outflow are at a minimum because flow through the wetland is highly channelized, and there is little net inflow or outflow to the system.

Groundwater budget numbers are driven by balance of precipitation and ET, as surface water inflow and outflow terms generally balanced each other. While it is standard practice to obtain net groundwater flux by resolving for residual, errors are inherent in procedure (e.g., Carter et al., 1979). Thus the largest uncertainties in the water and nutrient budgets are associated with net groundwater flux terms. Future research includes the validation of these budgets by quantifying groundwater interactions with the wetland, and measuring groundwater nutrient concentrations.

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CHAPTER 5

CONCLUSIONS

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5.1 SUMMARY

The coupling of wetlands with adjacent ecosystems provides a source of materials for new production within the wetland, and an energy subsidy for these adjacent systems. The forcing functions which control exchange across system boundaries vary both temporally and spatially, and therefore are a major source of variability in the patterns of material concentration and transport across the landscape. This research focused on the physical and biological processes responsible for such patterns in the SE Everglades wetlands and exchange with Florida Bay, USA. During the past century these two ecosystems have been severely degraded due to the diversion of freshwater flow from the Everglades watershed. Hydrological restoration of the SE Everglades will result in the diversion of agricultural drainage water to these wetlands, thus affecting the transport of nutrients through this wetlands and altering the magnitude of material exchange with Florida Bay. Understanding the processes controlling material exchange and the relative importance of inputs at the system boundaries will greatly further our understanding of the ecology and function of these wetlands, and aid in their management.

There are five characteristics of the energy signature of this geographical area that are responsible for the major spatio-temporal trends in material concentration and flux between SE Everglades and Florida Bay. These are: 1. the carbonate sedimentary environment of the Florida Bay and Everglades ecosystems; 2. the seasonal and spatial variation in surface freshwater input; 3. the proximity of creek basin to coastal ocean; 4. wind-driven forcing; and 5. differences in the geomorphology of the creek drainage basins. In the following paragraphs, I summarize the effects of these factors on material concentration in the SE Everglades and exchange with Florida Bay.

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5.1.1 Carbonate Sedimentary Environment

The carbonate sedimentary environment of the SE Everglades and Florida Bay exerts a major control on the availability of phosphorus in these ecosystems. Creeks surface waters were phosphorus limited, as indicated by high N:P ratios, low chlorophyll a concentration, and the correlation of the latter with phosphorus rather than nitrogen in all creeks. The extremely low export of P from the SE Everglades is a reflection of the efficiency of this ecosystem in retaining and recycling this limiting nutrient.

5.1.2 Seasonal and Spatial Variation in Surface Freshwater Input

The seasonal pulsing of freshwater input, and the decreasing influence of this input from east to west in the SE Everglades, was the most important element responsible for the spatio-temporal variations in total nutrient and organic carbon concentrations, and water and material exchange. Increasing freshwater input to the east decreases the residence time of wetland surface waters, and is responsible for maintaining the relatively higher N:P ratios and lower nutrient regime of the eastern creeks. The heavily export-dominated exchange, the westward decrease in net annual flux of nutrients and organic carbon, and large seasonal variation in flux associated with 99% percent of the material exported during the rainy season forcing are all indicators of the control of surface freshwater input on SE Everglades exchange with Florida Bay

5.1.3 Proximity to Coastal Ocean

The east to west decrease in TN:TP ratio from 212:1 to 127:1 is consistent with surface water and seagrass N:P ratios in Florida Bay and supports the hypothesis that the GOM is a major source of phosphorus to the western basin of Florida Bay. Higher nutrient concentrations (particularly P) in the western basin of Florida Bay are probably

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responsible for the higher biological productivity of the McCormick Creek wetlands and surface waters. Thus the degree of coupling of a creek drainage basin to the phosphorus-poor Everglades watershed relative to the phosphorus-rich GOM was responsible for spatial trends in N:P ratio and total nutrient and carbon concentration.

5.1.4 Wind-Driven Forcing

Wind-driven forcing was a major factor responsible for variations in 10-day creek discharge patterns. Seasonally, the effect of wind was most important when low freshwater head during the dry season coincided with strong southerly winds, resulting in a net import of water and materials into the wetlands. Spatially this effect was most visible in the western-most creek due to the lower input of surface freshwater. In addition, the effects of strong cold fronts or tropical storms exaggerated or completely overwhelmed forcing from freshwater input. These pulsing events play an important role in flushing the wetland surface waters of this extreme micro-tidal coastal environment.

5.1.5 Geomorphology of Creek Drainage Basin

Creek drainage basin geomorphology exerted controls on both magnitude and direction of water exchange and material concentration. The relative amount of open water versus contiguous wetland area determined the response of creek discharge to wind-driven forcing. Response to wind was dampened in basins with less open water and greater contiguous area of wetland. The geomorphology of the local drainage basin also exerted an influence on whether suspended sediment concentrations in creek surface waters were physically or biologically controlled. TSS was correlated to chlorophyll a in creeks that were directly coupled to brackish water lakes, where planktonic processes would exert a greater control on TSS. In the creek with the greater contiguous wetland

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area, TSS concentration was associated with wind-resuspension of Florida Bay sediments and the transport of these sediments into the wetland.

5.1.6 Water and Nutrient Budgets of the SE Everglades

A major objective of this research was to determine the relative importance of surface water versus atmospheric deposition, groundwater, and intrasystem cycling as nutrients sources and sinks to the SE Everglades wetlands. Atmospheric deposition was the dominant source of water and phosphorus for these wetlands, and as important as surface water inputs as a source of N. This is typical of oligotrophic ecosystems. Net groundwater flux was only significant during the dry season. The estimated import of P from hydrologic sources was within range of estimates of sediment P burial, but sediment burial of N greatly exceeded our estimate of hydrologic N import. Nitrogen fixation may partially account for the higher sediment burial rates, but the uncertainties in the estimate of groundwater flux into the area could likewise reduce the imbalance.

Further research is needed to understand the controls on nitrogen cycling in the SE Everglades, to observe the patterns of regional and local groundwater flow through this area, and to determine whether groundwater flow is a significant source of nutrients for the SE Everglades wetlands and Florida Bay. It is likely that a substantial amount of freshwater and nutrients enter Florida Bay via subsurface flow, thus greatly underestimating the contribution of freshwater input to the nutrient loading to Florida Bay. The maintenance of a low salinity regime in McCormick Creek, despite the limited of coupling of McCormick Creek with surface freshwater flows from the watershed, may be an indication of that groundwater flux into this area is significant. Finally, there is

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need for quantification of the rates of nitrogen transformation in these wetlands, and for better understanding of the effects of phosphorus-limitation on these rates.

5.1.7 Effects of Increased Freshwater Flow on Nutrient Loading and Potential Impacts on the Trophic State of Florida Bay

I evaluated the potential effects of hydrological restoration on nutrient loading to Florida Bay, and the potential for alteration of this trophic state of this ecosystem. There are several lines of evidence indicating that, while the hydrological restoration of the southern Everglades will result in increased nutrient transport to the Florida Bay, it will not likely result in increased eutrophication. First, comparison of our annual estimates of TN and TP export to with the whole Bay TN and TP budget indicates that surface freshwater input represent only 2% of N inputs, and less than 1% of P input to Florida Bay. Second, the material exported to Florida Bay from the SE Everglades has a mean TN:TP ratio of 170:1, which is much larger than the bay-wide average of 116:1. Third, ambient nutrient concentrations in the bay are higher than the flow-weighted mean concentration of these constituent in SE Everglades surface waters. Assuming concentrations of N and P in creek surface waters do not change as a result of hydrological restoration, the increasing input of freshwater could only result in a dilution of ambient N and P concentrations in Florida Bay water. For these reasons, I conclude that the impact of hydrological restoration of the southern Everglades on increasing eutrophication of Florida Bay will likely be minimal.

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APPENDICES

I. 10-Day Flux Study Data

This data set contains the material concentration, hydrologic, and physical forcing variables in 3 hour intervals for each 10-day flux study. On each record line, nutrient concentration analysis for the two replicates samples are given. A "." indicates missing data or that no sample was taken.

Variable(s)		Explanation/Comment
cr		Creeks are labeled as follows: 1 (McCormick), 2 (Taylor), and 3 (Trout)
mo		Values range from 1-29, and represent study months
dattime		Date and time variable
sno1	sno2	These are the reference sample numbers
sal1	sal2	Salinity from two replicates water samples at creek site (ppt)
chl1	chl2	chlorophyll a (μg/L)
tss1	tss2	Total suspended solids (mg/L)
om1	om2	Particulate organic matter (mg/L)
nn1	nn2	Nitrate and nitrite (μM)
no31	no32	Nitrate (μM)
no21	no22	Nitrite (μM)
nh41	nh42	Ammonium (μM)
srp1	srp2	Soluble reactive phosphorus (μM)
tp1	tp2	Total phosphorus (μM)
toc1	toc2	Total organic carbon (μM)
doc1	doc2	Dissolved organic carbon (μM)
tn1	tn2	Total nitrogen (μM)
don1	don2	Dissolved organic nitrogen (μM)
usgssal		3-hr USGS Salinity at creek site (ppt)

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	1	13Jan96:14:00	1.28	.	0.3	.	0.5	.	0.93	.	0.12	.	3.71	.	0.07	.	0.5	.	1043	.	1016	.	65.8	.	57.3	.	0.5
2	1	13Jan96:17:00	1.41	1.46	.	0.3	1.7	1.7	0.69	0.72	0.1	0.12	3.05	3.42	0.09	0.09	0.4	0.39	1056	1015	767	1020	62.3	63.6	44.4	54.7	0.6
2	1	13Jan96:20:00	1.36	1.21	1.0	.	1.0	1.2	0.85	0.94	0.18	0.24	3.12	3.86	0.13	0.28	0.32	0.4	955	986	1040	1068	59.9	59.6	51.7	61.2	0.6
2	1	13Jan96:23:00	1.16	1.44	.	2.6	0.2	1.3	1.02	0.8	0.13	0.09	3.01	2.85	0.1	0.01	0.39	0.37	997	1051	1005	998	63.7	58.9	59.1	52.8	0.6
2	1	14Jan96:02:00	1.07	0.98	0.5	.	1.2	1.2	0.59	0.61	0.1	0.28	2.88	3.68	0.04	0.33	0.37	0.33	1008	1016	1022	981	60.5	60.8	54.6	60	0.6
2	1	14Jan96:05:00	1.31	0.98	.	1.0	0.7	1.0	0.97	1.13	0.12	0.11	3.09	2.75	0.04	0.03	0.37	0.37	1058	1071	944	846	59.7	60.4	57.1	47.8	0.6
2	1	14Jan96:08:00	0.71	1.05	1.8	1.4	1.8	0.7	1.03	1.16	0.22	0.1	3.63	3.52	0.24	0.04	0.39	0.36	968	945	1017	997	59.4	63.9	57.5	57	0.6
2	1	14Jan96:11:00	1.02	0.97	1.3	0.8	2.5	1.9	1.2	0.82	0.1	0.09	4.05	4.19	0.02	0.03	0.39	0.43	1078	1075	945	1068	59.5	64.2	47.6	61.5	0.6
2	1	14Jan96:14:00	0.64	1.47	0.7	.	0.7	0.7	0.78	0.7	0.47	0.11	3.89	3.44	0.68	0.05	0.39	0.4	934	983	1014	1013	60.3	60.7	51	51.6	0.6
2	1	14Jan96:17:00	0.32	0.35	8.6	5.2	1.7	1.2	0.68	0.67	0.12	0.12	2.54	2.51	0.06	0.02	0.28	0.29	934	914	969	977	54.2	53.4	51.8	53	0.7
2	1	14Jan96:20:00	0.49	0.77	.	1.4	.	6.1	0.58	0.64	0.25	0.1	1.01	0.88	0.32	0.03	0.27	0.29	878	874	913	915	48.7	49.1	46.7	42.2	0.6
2	1	14Jan96:23:00	0.61	1.09	7.8	11.8	2.6	3.0	0.73	0.65	0.12	0.13	1.26	1.47	0.02	0.05	0.26	0.32	900	906	938	939	44.2	47.2	44.7	46.5	0.6
2	1	15Jan96:02:00	1.34	0.66	3.1	2.1	2.4	2.6	0.98	0.98	0.12	0.1	2.82	2.89	0.06	0.01	0.39	0.4	1079	1001	1088	1000	52.7	59.9	50.8	49.6	0.6
2	1	15Jan96:05:00	1.06	0.99	1.4	2.6	1.0	2.1	0.99	1.04	0.1	0.11	3.19	3.19	0.01	0.01	0.38	0.43	1057	1045	1042	1018	101	74.6	49.2	48.5	0.5
2	1	15Jan96:08:00	1.15	1.28	2.9	4.3	1.8	3.2	0.91	0.91	0.11	0.13	3.29	3.44	0.03	0.04	0.48	0.53	1090	1073	1033	1017	72.6	64.3	51.4	51.9	0.5
2	1	15Jan96:11:00	1.91	1.97	.	3.6	1.4	2.1	0.96	1.1	0.15	0.13	3.91	4.16	0.04	0.03	0.51	0.61	1088	1123	1045	1012	67.2	68.5	47	52.5	0.5
2	1	15Jan96:14:00	2.64	1.66	2.9	1.2	1.4	2.1	1.66	0.92	0.14	0.13	4.39	3.58	0.09	0.03	0.42	0.41	980	983	1103	1081	62	62.7	75.6	59.7	0.6
2	1	15Jan96:17:00	1.50	1.68	.	3.1	0.4	2.8	1.09	1.17	0.12	0.09	3.38	3.34	0.12	0.02	0.39	0.43	999	940	1037	1013	63.3	63.8	59.2	53.7	0.6
2	1	15Jan96:20:00	1.24	1.28	2.2	0.6	1.4	0.8	1.08	0.93	0.08	0.1	2.75	2.87	0.03	0.04	0.65	0.38	1076	1062	1034	1027	65.3	65.3	54	53.9	0.6
2	1	15Jan96:23:00	1.14	1.18	2.0	3.3	2.0	2.1	0.98	0.96	0.1	0.09	2.74	2.82	0	0.01	0.36	0.37	1115	1095	1066	1057	66.2	63.3	54.6	56.5	0.6
2	1	16Jan96:02:00	1.17	1.11	0.6	0.8	0.6	.	0.99	0.88	0.14	0.09	2.89	2.82	0.07	0.02	0.37	0.39	1087	1092	1072	1038	60.9	65.6	56.9	56.3	0.6
2	1	16Jan96:05:00	0.98	1.08	0.2	0.2	.	1.2	1.03	1.09	0.13	0.11	3.27	3.02	0.06	0.02	0.37	0.39	1067	1080	1104	1049	61.7	67.5	58.4	57.1	0.6
2	1	16Jan96:08:00	1.45	1.27	.	4.2	1.7	3.1	1.22	0.78	0.12	0.09	3.51	2.89	0.04	0.01	0.48	0.52	1111	1095	1044	858	57.9	64.1	54.4	43.9	0.6
2	1	16Jan96:11:00	1.50	1.94	2.4	3.4	1.9	2.9	1.08	1.08	0.12	0.12	3.62	3.65	0.02	0.03	0.47	0.5	1073	1082	1080	1073	64.5	62.8	52.6	54	0.8
2	1	16Jan96:14:00	1.23	1.70	6.1	17.1	2.9	5.4	0.69	0.66	0.13	0.12	2.08	2.06	0.11	0.1	0.36	0.37	942	906	961	945	57.8	54.8	49	47.8	1.5
2	1	16Jan96:17:00	1.61	1.83	1.1	1.1	2.5	3.2	1.17	1.14	0.1	0.09	3.22	3.23	0.06	0.03	0.52	0.52	1097	1089	1114	1065	60.8	62	51.3	54.3	0.9
2	1	16Jan96:20:00	1.81	1.70	6.4	3.2	2.5	3.2	1.18	1.23	0.1	0.09	3.08	2.88	0.04	0.01	0.49	0.47	1051	1033	1102	1069	64.2	66.1	55.2	54.3	0.7
2	1	16Jan96:23:00	1.21	1.36	.	.	2.2	2.5	1.21	1.09	0.1	0.1	2.85	2.91	0.05	0.06	0.54	0.51	1091	1075	1081	1076	59.2	62	58	53.7	1.1
2	1	17Jan96:02:00	1.11	1.58	2.9	1.9	1.1	1.4	1.06	1.04	0.1	0.11	2.9	2.92	0.03	0.02	0.44	0.44	1083	1073	1053	1053	63.1	62	52.5	51.7	0.8
2	1	17Jan96:05:00	1.38	1.54	0.7	2.1	1.8	2.5	1	1.08	0.1	0.11	3.03	3	0.05	0.04	0.47	0.48	1050	1004	1088	1066	61.1	59.1	56.1	53.4	0.7
2	1	17Jan96:08:00	1.72	1.13	5.7	4.6	3.9	3.6	1.14	1.16	0.11	0.1	3.35	3.38	0.03	0.04	0.64	0.61	971	956	1088	1062	66	68.9	54.8	62	0.6
2	1	17Jan96:11:00	1.66	1.88	5.4	1.9	3.6	1.9	0.92	0.94	0.09	0.09	3.73	3.79	0.06	0.04	0.36	0.34	1050	1025	1088	1077	67.4	71.1	57.4	57.6	1.0
2	1	17Jan96:14:00	1.80	1.98	2.9	4.3	.	1.4	0.57	0.47	0.09	0.08	3.95	4.12	0.04	0.04	0.46	0.48	1081	1034	1085	1084	69.2	71.2	60.3	60.9	0.9
2	1	17Jan96:17:00	1.43	1.71	4.6	6.1	1.4	3.6	0.94	.	0.09	.	3.96	.	0.04	.	0.5	0.51	1060	1051	1090	.	72.2	71	58.8	.	0.8
2	1	17Jan96:20:00	1.48	1.39	20.0	1.8	3.6	1.1	0.98	0.97	0.09	0.09	2.04	1.35	0.03	0.01	0.42	0.43	1106	1096	1043	1082	71.9	68.7	58.3	57.3	0.7
2	1	17Jan96:23:00	1.36	1.42	0.7	.	1.8	1.4	0.96	0.93	0.1	0.1	1.29	1.27	0	0	0.43	0.37	1087	1062	1059	1050	67.2	66.2	60.4	60.2	1.1
2	1	18Jan96:02:00	0.45	0.43	16.8	17.2	3.9	4.4	0.33	0.33	0.11	0.11	1.2	0.96	0.1	0.1	0.26	0.27	877	863	888	871	53.8	53.4	48.7	61.1	1.4
2	1	18Jan96:05:00	1.34	1.31	5.0	3.6	2.5	2.9	0.97	1	0.12	0.11	3.52	3.41	0.03	0.02	0.41	0.39	1053	1055	1018	1043	61.6	61.9	56.9	55.6	1.1
2	1	18Jan96:08:00	1.15	1.36	10.3	8.8	4.7	6.9	0.85	0.9	0.14	0.13	3.5	3.39	0.05	0.02	0.46	0.45	1019	1034	1049	1048	59.6	59.1	56.6	51.8	1.2
2	1	18Jan96:11:00	1.35	1.15	9.1	9.4	3.8	1.9	0.28	0.32	0.11	0.12	2.75	2.85	0.04	0.05	0.41	0.38	1205	1001	1002	1033	55.9	55.7	51.5	52.1	1.4
2	1	18Jan96:14:00	0.45	0.74	15.0	14.1	2.5	3.8	0.11	0.12	0.07	0.11	1.04	1.05	0.09	0.09	0.28	0.26	874	852	916	914	46.7	74.8	47.5	44.2	1.5
2	1	18Jan96:17:00	1.32	1.48	11.4	12.9	4.3	1.8	0.39	0.87	0.13	0.13	3.12	3.43	0.05	0.05	0.44	0.45	984	995	1002	1007	54.4	58.8	50.8	52.5	1.2
2	1	18Jan96:20:00	0.52	0.50	19.3	19.3	5.7	5.4	0.3	0.28	0.13	0.14	1.09	1	0.09	0.09	0.31	0.27	883	863	923	908	49.4	50.6	45	47.9	1.2
2	1	18Jan96:23:00	0.36	0.44	6.6	13.8	0.0	3.1	0.23	0.22	0.18	0.2	1.07	1.07	0.16	0.15	0.23	0.27	868	866	926	921	48.4	49.9	48	44	2.9
2	1	19Jan96:02:00	0.34	0.30	0.6	29.1	3.1	7.3	0.16	0.18	0.21	0.22	1.14	1.51	0.13	0.12	0.23	0.3	892	905	938	943	50.4	52.8	47.3	47.6	6.3
2	1	19Jan96:05:00	0.46	1.26	15.0	.	3.2	1.8	0.15	1.66	0.13	0.2	1.09	3.49	0.01	0.02	0.25	0.36	878	959	926	1050	47.1	55.3	46	55.3	6.6
2	1	19Jan96:08:00	0.47	0.51	13.4	22.1	3.1	7.2	0.33	0.39	0.13	0.11	1.7	1.5	0.12	0.11	0.31	0.32	893	872	936	924	47.2	47.6	49.1	45.4	3.8
2	1	19Jan96:11:00	1.00	0.88	14.3	10.0	5.7	2.9	0.35	0.34	0.12	0.13	0.87	1.16	0.1	0.11	0.3	0.29	878	905	918	939	45.8	46.2	45.5	44.7	4.8
2	1	19Jan96:14:00	0.84	0.89	6.9	10.7	1.9	2.9	0.25	0.27	0.21	0.12	1.12	0.89	0.13	0.02	0.27	0.29	914	881	926	929	45	41.8	43.4	42.6	8.6
2	1	19Jan96:17:00	0.51	0.64	7.4	7.6	3.6	4.0	0.29	0.3	0.13	0.13	1.33	1.27	0.03	0.1	0.34	0.32	886	869	942	945	44	45.7	46.1	45.5	8.7

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	1	19Jan96:20:00	0.91	1.04	9.5	12.6	2.9	4.3	0.71	0.84	0.13	0.15	1.84	2.23	0.07	0.09	0.43	0.44	969	973	841	841	47.7	48	50.1	50.4	4.0
2	1	19Jan96:23:00	0.51	0.52	12.6	15.0	3.6	4.8	0.41	0.37	0.18	0.16	1.24	1.09	0.09	0.08	0.31	0.19	915	923	764	741	41.9	38	44.5	44.9	3.0
2	1	20Jan96:02:00	0.53	0.58	11.9	13.9	4.5	3.9	0.58	0.6	0.22	0.17	2.28	1.99	0.07	0.07	0.27	0.27	939	960	776	748	42.7	43.9	45.1	45.4	2.8
2	1	20Jan96:05:00	1.40	1.39	4.6	7.5	3.6	3.6	0.91	1.11	0.16	0.16	2.69	2.66	0.04	0.05	0.36	0.33	1011	983	709	908	49.6	50.2	40.8	54	2.2
2	1	20Jan96:08:00	0.94	1.71	5.7	7.9	2.5	3.6	1.07	1.09	0.13	0.12	3.11	3.16	0.03	0.05	0.41	0.63	1016	1012	888	924	54	56.7	54	54.1	1.9
2	1	20Jan96:11:00	1.36	1.10	16.3	12.9	5.4	4.3	0.82	0.78	0.15	0.16	2.29	2.31	0.06	0.07	0.45	0.47	998	993	.	.	54.4	55.6	.	.	2.3
2	1	20Jan96:14:00	0.70	0.57	13.9	13.9	3.2	3.6	0.3	0.29	0.16	0.14	1	0.87	0.02	0.02	0.35	0.32	946	929	.	.	45.5	45.6	.	.	4.4
2	1	20Jan96:17:00	0.70	1.04	15.4	17.5	4.3	5.4	0.61	0.58	0.17	0.2	1.87	1.93	0.01	0	0.48	0.43	943	956	.	.	47.5	47.4	.	.	3.8
2	1	20Jan96:20:00	1.68	1.10	2.9	3.2	2.1	2.5	1.19	1.23	0.17	0.14	2.34	2.54	0.05	0.08	0.69	0.52	1108	1086	.	913	54	54.6	.	56.4	2.7
2	1	20Jan96:23:00	1.02	0.52	10.7	13.2	2.9	3.6	0.44	0.39	0.18	0.16	1.19	1.1	0.08	0.08	0.37	0.36	974	953	.	.	47.1	44.3	.	.	1.9
2	1	21Jan96:02:00	0.80	0.75	17.5	21.1	5.4	5.4	0.51	0.47	0.19	0.2	1.19	1.17	0.11	0.1	0.32	0.33	946	949	.	.	45.7	45.3	.	.	2.5
2	1	21Jan96:05:00	0.95	1.17	6.1	8.2	1.1	2.1	0.99	0.93	0.15	0.15	2.12	2.1	0.07	0.06	0.43	0.44	1053	1047	.	.	51.1	49.7	.	.	2.0
2	1	21Jan96:08:00	1.54	1.20	12.5	15.0	4.3	5.3	0.84	0.83	0.14	0.17	2.18	2.35	0.07	0.1	0.43	0.41	1088	1051	.	.	54	55.8	.	.	1.7
2	1	21Jan96:11:00	4.47	0.59	36.8	20.7	6.3	5.7	0.33	0.55	0.2	0.21	1.25	1.37	0.13	0.12	0.25	0.33	946	955	.	753	47.1	47.8	.	48.3	1.8
2	5	15May96:20:00	0.52	1.00	12.3	15.0	2.7	.	.	.	.	.	.	.	.	.	.	.	858	834	.	.	74.4	66.8	0	61.8	23.1
2	5	15May96:23:00	0.55	0.29	12.5	24.7	4.0	6.0	1.03	1.07	0.21	0.22	5.26	5.59	0.05	0.04	.	0.34	870	853	775	782	64.7	65.2	58.7	62.3	22.9
2	5	16May96:02:00	0.59	0.91	26.4	28.6	3.9	6.1	0.47	0.38	0.15	0.14	3.42	3.37	0.03	0.06	0.34	.	908	800	975	832	62.8	66.9	59.6	59.8	22.0
2	5	16May96:05:00	3.28	1.28	25.4	30.7	5.7	5.7	.	1.41	.	0.26	.	5.89	.	0.03	0.99	.	871	839	.	817	65.5	61.1	67.9	62.6	22.9
2	5	16May96:08:00	2.28	2.19	30.7	32.9	6.4	8.6	1.26	1.25	0.23	0.23	5.91	5.77	0.05	0.03	.	0.55	865	892	861	836	93.4	63.1	65.2	65.4	22.8
2	5	16May96:11:00	2.03	2.32	28.9	26.4	6.1	5.7	1.27	1.38	0.22	0.24	5.85	5.43	0.1	0.1	.	.	886	795	840	789	70.6	65.7	61.3	60.9	22.6
2	5	16May96:14:00	4.74	3.64	30.6	25.0	9.4	6.8	1.32	1.3	0.23	0.22	5.25	5	0.01	0.05	.	0.7	921	906	836	890	63.9	68.5	56.1	57.9	22.9
2	5	16May96:17:00	2.84	2.19	31.4	45.0	7.9	10.0	.	0.95	.	0.19	.	4.19	.	0.03	0.55	0.57	926	923	.	.	67.4	65.1	53.5	61.4	23.1
2	5	16May96:20:00	4.10	4.65	35.0	37.0	7.5	10.5	.	.	.	.	.	.	.	.	0.61	0.63	932	920	.	.	70.7	68	62.1	61.1	23.1
2	5	16May96:23:00	4.65	4.65	36.0	24.5	7.0	9.5	.	1.08	.	0.16	.	1.81	.	0.1		0.66	925	944	.	883	59.1	67.9	60.1	57.7	23.0
2	5	17May96:02:00	2.73	2.92	40.5	43.0	11.0	9.0	.	.	.	.	.	.	.	.	.	.	916	923	795	601	67	92.1	58.1	49.9	23.0
2	5	17May96:05:00	2.28	4.46	42.0	50.0	12.7	5.0	0.98	.	0.1	.	1.88	.	.	.	.	.	884	869	679	919	61	60.9	37.5	48.2	23.1
2	5	17May96:08:00	3.92	3.92	52.9	59.3	15.7	15.0	.	.	.	.	.	.	.	.	.	0.85	871	941			70.2	68.1	53.4	47	23.0
2	5	17May96:11:00	2.64	2.72	65.7	1.4	18.6	5.7	.	.	.	.	.	.	.	.	0.7	.	918	881		.	64.6	69.9	41.1	61.8	23.2
2	5	17May96:14:00	2.14	2.14	39.3	55.7	10.7	22.9	.	1.05	.	0.26	.	5.48	.	0.02	2.11	0.52	905	897		777	68.7	66.5	53	57.9	23.3
2	5	17May96:17:00	0.93	0.84	78.6	.	85.0	.	.	3.03	.	0.17	.	3.61	.	0.09	0.48	0.52	955	924		808	61.4	70.5	62.9	63.9	23.6
2	5	17May96:20:00	0.85	1.03	35.0	60.7	7.1	15.7	.	1.39	.	0.36	.	6.41	.	0.06	0.48	0.55	897	863		806	67.9	68.8	59.6	66.2	23.6
2	5	17May96:23:00	2.51	1.55	52.1	40.0	13.6	12.9	1.59	4.04	0.31	0.28	6.5	5.57	0.22	0.24		0.68	883	902	891	751	61.2	66.1	63.1	63.4	22.4
2	5	18May96:02:00	3.74	3.83	41.4	45.0	10.0	12.9	2.99	0.74	1.38	0.2	4.49	4.76	0.07	0.09	0.66	0.68	926	873	724	699	69.2	77.7	65.3	63.5	21.0
2	5	18May96:05:00	1.18	0.82	47.1	2.9	13.6	5.0	2.46	1.27	0.22	0.23	5.15	6.65	0.03	0.05	0.5	0.67	838	835	679	722	64.6	72.1	61.9	57.4	21.2
2	5	18May96:08:00	1.69	1.91	52.9	55.7	16.4	15.0	0.38	.	0.11		1.31	.	0.07	.	0.62	0.39	837	851	726	.	69.3	67.6	63.6	40.5	21.1
2	5	18May96:11:00	8.66	.	52.9	.			0.09	.	0.08		0.76	.	0.06		1.07	.	910	.	819	.	65	.	51	.	20.6
2	5	18May96:14:00	10.93	10.30	58.6	54.3	11.4	12.1	0.1	0.16	0.11	0.13	0.98	2.84	0.03	0.02	1.11	2.42	920	913	911	720	68.2	71.1	56.7	42.6	20.3
2	5	18May96:17:00	1.09	1.02	65.7	62.9	12.9	14.3	0.16	0.23	0.13	0.12	2.74	3.29	0.05	0.05	1.08	0.49	852	829	823	933	62.5	65.1	51.1	55.3	21.3
2	5	18May96:20:00	0.50	0.64	50.5	67.0	8.0	14.0	0.13	0.24	0.1	0.16	2.77	2.89	0.06	0.07	0.47	0.44	840	838	952	715	63.2	64.9	54.9	43	21.7
2	5	18May96:23:00	0.51	0.57	5.5	17.5	3.5	.	1.47	0.3	0.3	0.14	6.43	2.69	0.07	0.02	0.45	0.44	830	822	911	913	71.3	68.6	63.6	60.4	21.9
2	5	19May96:02:00	0.68	0.59	29.1	19.4	9.7	.	0.17	0.18	0.11	0.12	2.01	2	0.02	0.04	0.77	0.4	819	795	1039	930	63.9	58.1	64.6	60.8	22.2
2	5	19May96:05:00	0.47	0.51	11.3	12.0	3.3	4.4	0.27	0.29	0.13	0.15	2.54	2.68	0.03	0.04	0.24	0.29	812	796	943	901	61.2	58.6	56.5	62.6	21.9
2	5	19May96:08:00	0.78	0.98	11.6	12.4	3.2	.	0.5	0.56	0.18	0.19	3.8	4.05	0.02	0.04	0.27	0.38	816	790	933	928	62.6	63.6	58.5	64.1	21.7
2	5	19May96:11:00	2.73	1.00	14.0	16.8	4.4	7.2	0.66	0.66	0.17	0.17	4.72	4.66	0.04	0.04	0.41	0.59	823	816	948	940	69	63.9	61.6	63.9	21.9
2	5	19May96:14:00	3.75	3.78	8.5	19.0	6.0	6.5	0.85	0.86	0.21	0.2	4.86	4.77	0.04	0.04	0.55	0.58	855	840	956	951	61.7	62.4	63.8	58.8	22.0
2	5	19May96:17:00	0.64	0.32	76.9	77.7	15.4	13.8	1.7	1.71	0.27	0.32	.	.	.	.	0.65	0.51	800	796	715	623	59.2	61.7	54.3	59.6	22.0
2	5	19May96:20:00	0.88	0.40	106.7	43.3	18.1	11.7	1.78	1.23	0.15	0.47	.	.	.	.	0.44	0.69	787	778	681	706	56.8	59.2	50.9	61.1	22.1
2	5	19May96:23:00	0.20	0.25	32.3	56.9	4.6	3.8	0.22	0.27	0.18	0.17	3.49	4.68	0.05	0.05	0.58	0.37	807	789	928	937	57.4	60.4	64.3	53.4	22.4
2	5	20May96:02:00	0.50	0.36	55.7	77.9	13.6	15.7	0.17	0.13	0.16	0.15	2.71	2.83	0.07	0.06	0.35	0.49	759	766	909	908	57.1	56.8	53.8	53.7	22.8
2	5	20May96:05:00	0.11	0.22	50.8	52.3	13.8	12.3	0.25	0.3	0.17	0.16	3.65	3.51	0.04	0.03	0.97	0.36	792	761	883	886	58.3	58.4	52.4	54.6	23.0
2	5	20May96:08:00	0.47	0.52	51.5	53.8	8.5	4.6	0.6	0.51	0.25	0.17	4.74	4.25	0.07	0	0.3	0.27	947	934	863	888	59.6	57.9	58.6	49.6	22.8

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	5	20May96:11:00	2.10	1.75	35.0	46.4	8.6	11.4	.	.	.	.	.	.			0.46	0.36	1084	1073	713	704	58.4	57.7	57.7	61.5	23.1
2	5	20May96:14:00	.	.	.	.	.	.	.	.	.	.	.	.			0.81	.	1044		.	.	58.6	.	57.9	.	22.8
2	5	20May96:17:00	2.20	.	87.8		.		.	.		.	.	.	.	.		.	.	.	.	.	.	.	.	.	22.6
2	5	20May96:20:00	0.82	0.59	107.1	74.3	23.6	17.9	.	0.63	.	0.22	.	5.74		0.38	1.5	0.44	1058	1100	773	960	61.7	64.4	.	69.6	22.9
2	5	20May96:23:00	0.48	0.64	23.6	72.1	5.7	22.1	0.28	.	0.15	.	4.18	.	0.04	.	0.49	0.88	1085	1080	917	779	60.4	60.4	59.9	56.4	22.1
2	5	21May96:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.8
2	5	21May96:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.2
2	5	21May96:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.2
2	5	21May96:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.0
2	5	21May96:14:00	1.66	1.45	52.0	61.0	.	16.0	0.51	0.43	0.26	0.26	4.34	4.75	0	0.01	0.55	0.5	1024	1130	856	927	62.4	56.3	53.4	62	24.0
2	5	21May96:17:00	1.19	.	53.0	47.0	.	.	0.62	0.65	0.32	0.32	4.28	4.49	0.03	0.06	0.6	0.55	995	968	842	830	53.4	52.8	57.6	56.1	24.2
2	5	21May96:20:00	0.45	0.83	56.0	60.0	.	13.0	0.64	0.67	0.31	0.29	4.91	5.31	0.02	0.02	0.49	0.64	998	957	836	798	53.6	54.5	55	51.6	23.8
2	5	21May96:23:00	0.88	0.92	53.3	60.0	.	15.0	0.52	0.51	0.27	0.26	5.09	5.54	0.05	0.07	0.51	1.86	1026	993	886	828	56.9	63.4	52.8	49.7	23.9
2	5	22May96:02:00	0.64	0.73	60.0	67.0	27.0	19.0	0.59	0.62	0.26	0.28	5.82	6.41	0.06	0.05	0.46	0.43	1002	772	825	821	61.6	67.3	54.6	55.1	23.9
2	5	22May96:05:00	0.93	0.80	37.0	42.0	2.0	.	0.63	0.62	0.27	0.26	6.81	6.86	0.03	0.06	0.53	0.58	1011	1000	833	832	60.6	61.1	53.9	54.9	23.8
2	5	22May96:08:00	0.73	0.64	15.5	16.5	.	.	0.88	0.86	0.33	0.34	8.05	8.38	0.04	0.07	0.51	0.29	804	786	856	901	65.3	62.6	55.8	55.6	23.6
2	5	22May96:11:00	1.08	1.08	20.7	20.7	2.0	.	0.63	0.63	0.3	0.31	7.62	8.17	0.06	0.08	0.55	0.34	821	808	885	918	59.7	61.6	54.3	58.6	23.5
2	5	22May96:14:00	0.78	1.03	28.0	30.7	.	.	0.56	0.55	0.28	0.27	7.92	7.93	0.05	0.05	0.31	0.24	837	846	906	873	60.1	59.8	62.4	61.1	23.4
2	5	22May96:17:00	0.83	0.83	26.7	25.3	14.0	20.0	0.49	0.49	0.27	0.26	7.15	7.34	0.05	0.03	0.28	0.45	850	827	914	867	55.5	57.5	61.3	59.1	23.4
2	5	22May96:20:00	0.65	0.82	33.3	34.0	16.7	19.3	0.53	0.5	0.29	0.29	6.88	6.85	0.03	0.03	0.37	0.3	821	762	943	936	66.7	64.6	64.1	61.6	23.3
2	5	22May96:23:00	0.65	0.72	40.7	46.0	16.7	24.0	0.59	0.58	0.3	0.3	7.51	7.61	0.05	0.05	0.32	0.32	787	757	882	871	62.7	61.6	63.6	61.8	23.5
2	5	23May96:02:00	0.61	0.23	34.0	66.0	.	48.0	0.68	0.62	0.34	0.31	8.09	5.65	0.02	0.01	0.43	0.42	802	787	929	902	62.4	60.6	62.4	58.3	23.5
2	5	23May96:05:00	0.71	0.73	37.3	34.7	25.3	8.0	0.66	0.64	0.33	0.34	6.34	6.53	0.03	0.02	0.39	0.37	795	764	861	853	59.7	64.4	57.4	50.2	23.6
2	5	23May96:08:00	0.88	0.77	21.1	22.3	11.4	9.1	0.6	0.59	0.33	0.34	6.34	6.46	0.03	0.02	0.48	0.28	824	794	874	842	60.7	54.9	56.4	49.2	23.6
2	5	23May96:11:00	0.82	1.00	50.7	53.6	38.6	42.1	0.59	0.6	0.31	0.33	6.26	6.24	0.04	0.05	0.52	0.22	801	800	842	856	0	60.2	65.6	48.2	23.7
2	5	23May96:14:00	0.76	0.69	36.8	62.1	31.4	30.7	0.55	0.56	0.28	0.33	5.15	5.87	0.04	0.02	0.66	0.31	879	859	935	863	60.8	63.7	74.6	63.4	23.5
2	5	23May96:17:00	0.82	0.55	65.7	60.7	36.4	53.6	0.38	0.52	0.25	0.29	4.74	4.66	0.02	0.02	0.35	0.47	859	865	1001	889	60.5	59.5	108	68.8	23.5
2	5	23May96:20:00	0.64	0.89	65.0	70.0	44.3	47.9	0.49	0.48	0.31	0.33	3.92	3.97	0.02	0.03	0.49	0.54	816	803	938	900	65.6	62.1	58.6	42.9	23.4
2	5	23May96:23:00	0.35	0.55	50.0	67.1	5.0	26.4	0.6	0.61	0.34	0.35	4.74	5.01	0.01	0.02	0.25	0.27	778	771	888	734	58.2	59.1	54.2	55.4	23.4
2	5	24May96:02:00	0.64	0.37	77.1	27.1	20.0	.	0.57	0.6	0.33	0.35	5.06	5.38	0.01	0.01	0.21	0.2	795	774	711	701	58.1	55.1	43.6	42.4	23.6
2	5	24May96:05:00	.	0.87	124.4	137.5	44.4	100.0	0.7	0.66	0.36	0.34	5.89	6	0.03	0.03	0.22	0.22	792	736	667	698	54.9	54.8	48.4	49.6	23.6
2	5	24May96:08:00	0.91	0.87	65.0	70.0	15.0	17.9	0.68	0.74	0.35	0.35	6.63	6.83	0.03	0.03	0.19	0.2	736	721	667	677	58.3	54	51.1	49.9	23.9
2	5	24May96:11:00	0.77	0.82	50.0	67.1	13.6	15.0	0.68	0.68	0.34	0.34	6.4	6.32	0.04	0.01	0.27	0.25	723	743	712	731	55.8	54.1	51.9	53.4	23.7
2	5	24May96:14:00	0.91	0.64	77.1	27.1	18.6	6.4	0.75	0.74	0.33	0.34	6.45	6.86	0.02	0.02	0.26	0.26	769	831	684	775	57.6	56.9	48	52.9	23.6
2	5	24May96:17:00	0.68	1.52	124.4	137.5	46.7	31.3	0.57	0.61	0.3	0.34	5.44	6.14	0.04	0.03	0.45	0.96	839	857	777	674	58.5	56.9	40.6	57.4	23.7
2	8	14Aug96:17:00	1.64	1.49	24.0	16.7	.	5.3	2.71	2.92	0.51	0.53	2.4	2.86	0.06	0.06	0.25	0.26	1025	956	1017	966	75.1	79.5	69.5	73.2	7.6
2	8	14Aug96:20:00	1.59	1.09	11.8	18.7	.	4.7	2.21	2.49	0.48	0.48	2.99	2.63	0.09	0.02	0.28	0.3	973	976	1014	978	78.6	77.4	72.9	71.8	7.4
2	8	14Aug96:23:00	1.23	0.98	12.6	13.1	.	.	3.5	2.91	0.49	0.5	3.32	3.69	0.02	0.06	0.41	0.34	998	990	988	985	77.5	77.3	70.2	70.2	7.8
2	8	15Aug96:02:00	1.26	1.23	18.3	12.0	.	6.3	3.05	2.89	0.57	0.6	2.65	3.19	0.04	0.07	0.27	0.28	953	938	983	919	73.4	75.7	67.1	69.1	7.6
2	8	15Aug96:05:00	1.09	1.05	10.8	10.2	5.6	5.1	2.57	2.34	0.44	0.44	3.55	3.97	0.05	0.07	0.34	0.34	1020	1019	1033	993	78.5	79	71.9	72.2	7.6
2	8	15Aug96:08:00	1.28	1.50	21.1	15.3	.	3.3	2.42	2.56	0.61	0.57	4.98	4.96	0.07	0.06	0.34	0.33	1035	1039	1036	1044	78.7	82.5	70.7	74.4	6.6
2	8	15Aug96:11:00	1.55	1.82	27.2	28.0	15.2	15.2	1.92	2.17	0.59	0.62	4.54	4.7	0.07	0.06	0.34	0.32	1014	989	978	993	80.8	80.8	73.8	73.3	4.9
2	8	15Aug96:14:00	1.50	1.41	18.0	24.0	3.3	.	2.49	2.71	0.5	0.5	2.64	2.8	0.04	0.05	0.32	0.29	993	978	1073	1049	71.7	69.4	66.1	63.3	7.5
2	8	15Aug96:17:00	1.32	1.75	17.3	22.7	9.3	.	2.36	2.04	0.53	0.47	2.87	2.01	0.09	0.08	0.28	0.31	984	970	1011	1068	69.6	70.4	63.8	65.9	8.5
2	8	15Aug96:20:00	1.28	1.59	7.3	6.0	4.0	2.7	1.86	1.59	0.32	0.27	3.69	3.55	0.01	0.03	0.41	0.43	1274	1260	1383	1163	82.4	85.3	76.6	79.9	6.7
2	8	15Aug96:23:00	1.37	1.37	14.7	9.3	2.7	8.0	1.83	1.97	0.59	0.59	3.75	3.84	0.03	0.04	0.34	0.32	1013	985	1084	1066	72.9	70.9	66.8	64.5	4.8
2	8	16Aug96:02:00	1.09	1.26	14.7	14.0	.	8.0	2.3	2.14	0.57	0.57	3.16	3.04	0.04	0.03	0.29	0.3	987	1020	1039	1074	72.6	72.2	66.5	66.5	9.0
2	8	16Aug96:05:00	1.18	1.09	16.6	18.3	3.4	8.6	2.14	1.98	0.56	0.55	3.22	3.6	0.04	0.05	0.3	0.3	992	993	974	1038	69	70.6	63.1	64.5	8.9
2	8	16Aug96:08:00	1.64	1.96	20.7	20.7	.	8.0	1.73	1.59	0.47	0.44	3.24	2.38	0.07	0.04	0.3	0.33	978	1063	997	1033	67.6	71.1	62.1	66.7	8.8
2	8	16Aug96:11:00	1.96	2.28	5.7	8.0	5.1	3.4	2.17	2.26	0.36	0.39	4.14	4.67	0.03	0.05	0.42	0.41	1171	1185	1195	1170	74.5	78.1	67.8	70.7	7.5
2	8	16Aug96:14:00	2.55	2.64	10.3	11.4	3.4	4.6	2.09	2.11	0.28	0.31	4.19	4.68	0.01	0.03	0.49	0.48	1308	1305	1336	1324	88.1	91.5	81.5	84.4	4.3

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	8	16Aug96:17:00	1.09	1.69	22.7	19.2	7.3	.	1.54	1.58	0.5	0.45	2.54	2.4	0.14	0.05	0.34	0.32	1025	1011	1092	1013	74.6	72.9	70	68.5	5.6
2	8	16Aug96:20:00	.	.	30.0	28.0	11.0	15.2	1.42	1.51	0.43	0.44	2.06	2.14	0.03	0.02	0.36	0.4	1018	998	1008	989	74.3	71.4	70.4	67.3	6.6
2	8	16Aug96:23:00	.	.	7.3	8.7	2.0	4.0	1.79	1.37	0.26	0.27	4.29	4.6	0.03	0.04	0.62	0.5	1396	1401	1367	1361	91.9	89	85.5	82.8	.
2	8	17Aug96:02:00	.	.	12.7	38.0	7.3	12.7	1.27	1.08	0.57	0.58	3.81	3.8	0.04	0.02	0.47	0.35	1059	1025	998	1062	75.4	75.6	69.8	70.1	.
2	8	17Aug96:05:00	.	.	16.0	18.0	7.3	3.3	4.16	2.35	0.54	0.54	3.33	3.21	0.07	0.09	0.38	0.32	1023	1005	1027	1023	74.8	73	66.8	66.9	.
2	8	17Aug96:08:00	.	.	12.7	13.3	.	0.7	2.78	2.78	0.48	0.49	5.7	4.26	0.08	0.03	0.36	0.37	1067	1069	1084	1074	74.2	78.6	65.3	71	7.3
2	8	17Aug96:11:00	.	.	26.0	0.0	6.0	.	2.06	2.01	0.37	0.35	0.02	2.6	0.32	0.02	12.3	0.33	12.5	1055	1.07	1054	.	76	122	71.1	4.7
2	8	17Aug96:14:00	.	.	21.3	20.7	6.0	9.3	1.79	1.74	0.37	0.36	1.86	1.92	0	0.03	0.29	0.34	976	969	989	929	68.4	70	64.4	66	4.5
2	8	17Aug96:17:00	.	.	18.0	22.7	8.0	8.0	1.56	2.16	0.32	0.31	1.75	1.91	0.05	0.05	0.32	0.28	980	959	968	978	67.7	65.7	64	61.3	6.2
2	8	17Aug96:20:00	1.32	1.55	10.3	13.1	.	6.9	2.21	2.04	0.31	0.25	3.12	3.1	0.14	0.08	0.37	0.25	1316	1228	1210	1190	86.1	79.5	80.4	74.1	.
2	8	17Aug96:23:00	1.09	1.28	6.0	5.5	2.0	4.5	2.54	2.24	0.28	0.24	3.24	3.36	0.07	0.05	0.36	0.38	1320	1348	1284	1274	95.5	98.1	89.5	92.2	.
2	8	18Aug96:02:00	1.09	1.28	16.0	14.0	5.5	.	2.6	2.85	0.46	0.66	2.35	2.45	0.08	0.07	0.26	0.28	1076	1052	1023	992	83.2	88.5	77.8	82.6	.
2	8	18Aug96:05:00	0.00	1.18	6.0	4.0	3.5	2.5	2.35	2.12	0.27	0.3	3.41	3.56	0.07	0.48	0.35	0.33	1270	1283	1229	1229	87.5	87.1	81.5	81.1	.
2	8	18Aug96:08:00	1.73	1.64	13.1	16.0	4.6	5.1	1.96	2.2	0.36	0.37	3.01	3.04	0.07	0.06	0.34	0.41	1128	1085	1111	1070	83.5	78.3	78.1	72.6	.
2	8	18Aug96:11:00	2.64	2.73	9.1	6.9	5.5	2.9	2.41	1.96	0.24	0.23	3.66	3.76	0.06	0.02	0.45	0.46	1375	1394	1353	1228	94.5	94.2	88.2	88.2	.
2	8	18Aug96:14:00	1.78	1.64	5.1	8.6	1.7	5.1	2.13	2.11	0.22	0.26	3.38	3.3	0.03	0.06	0.44	0.4	1411	1375	1318	1287	93.1	90.9	87.4	85.2	.
2	8	18Aug96:17:00	1.46	1.46	18.9	16.0	7.4	5.1	2.08	1.95	0.43	0.42	1.54	1.71	0.05	0.07	0.27	0.3	1053	1023	1007	988	77.3	74	73.2	69.9	.
2	8	18Aug96:20:00	1.37	1.47	6.7	18.7	0.0	12.0	2.2	2.11	0.31	0.29	2.2	2.67	0.05	0.05	0.39	0.4	1221	1231	1173	1239	70.8	66.3	66.1	61.3	.
2	8	18Aug96:23:00	1.28	1.18	16.0	8.7	.	0.0	1.69	1.8	0.3	0.29	2.15	1.95	0.04	0.07	0.41	0.41	1159	1152	797	1158	71.3	76.9	67.2	72.9	.
2	8	19Aug96:02:00	1.32	1.09	14.7	10.0	14.7	9.3	2.24	1.99	0.18	0.2	3.01	3.11	0.02	0.03	0.47	0.53	1453	1470	1373	1371	92.8	94.7	87.3	89.4	.
2	8	19Aug96:05:00	1.05	1.09	6.5	4.0	3.5	0.0	2.27	2.43	0.18	0.25	3.2	3.21	0.01	0.02	0.47	0.47	1469	1472	1353	1371	92.8	101	87.1	94.7	1.8
2	8	19Aug96:08:00	1.55	1.55	8.0	6.0	4.7	3.3	1.7	1.85	0.18	0.12	4.63	4.81	0.08	0.1	0.52	0.65	1458	1481	1393	1438	98.6	101	92.1	94	2.0
2	8	19Aug96:11:00	1.78	1.64	20.6	21.7	9.1	5.1	1.69	1.9	0.29	0.31	2.31	2.21	0.03	0.04	0.33	0.38	1198	1168	1233	1170	85.9	83.2	81.7	78.8	.
2	8	19Aug96:14:00	1.23	1.96	15.3	23.3	9.3	7.3	2.34	1.99	0.37	0.29	1.95	1.81	0.09	0.06	0.37	0.32	1150	1163	1117	1202	82.8	82.3	78.1	78.2	5.8
2	8	19Aug96:17:00	1.18	1.78	15.3	15.3	7.3	6.7	2.65	2.02	0.34	0.3	1.94	1.95	0.06	0.06	0.38	0.35	1167	1148	1168	1106	82.4	80.1	77.5	75.8	6.1
2	8	19Aug96:20:00	1.28	1.41	8.0	8.0	4.5	1.5	2.41	2.71	0.24	0.28	2.99	3.39	0.06	0.12	0.39	0.39	1278	1278	1240	1262	85.3	91.3	79.6	85	.
2	8	19Aug96:23:00	1.87	1.50	4.0	4.0	1.6	2.0	2.3	2.29	0.21	0.22	2.78	2.51	0.04	0.11	0.5	0.47	1447	1453	1363	1468	94.6	92.9	89.3	87.8	.
2	8	20Aug96:02:00	1.14	1.00	4.0	4.0	1.6	1.6	1.99	2.2	0.16	0.17	3.08	3.13	0.07	0.06	0.49	0.5	1408	1383	1433	1379	90.6	91.7	85.4	86.2	1.0
2	8	20Aug96:05:00	1.23	1.41	4.4	4.0	3.2	3.6	2.17	1.84	0.16	0.16	3.35	3.38	0.06	0.06	0.43	0.45	1435	1449	1388	1377	89.9	92.3	84.2	86.9	1.4
2	8	20Aug96:08:00	1.64	.	2.4	.	0.0	.	2.24	.	0.18	.	3.44	.	0.07	.	0.45	.	1458	.	1398	.	93.8	.	88	.	1.5
2	8	20Aug96:11:00	2.82	3.19	2.7	2.7	3.3	2.0	2.5	2.39	0.22	0.21	3.74	4.19	0.09	0.07	0.52	0.44	1405	1411	1382	1386	93.3	94	86.9	87.3	1.9
2	8	20Aug96:14:00	1.85	1.78	20.0	20.0	4.7	6.7	2.52	2.51	0.56	0.57	2.3	2.62	0.07	0.05	0.33	0.37	1131	1093	1131	1078	80.9	76.9	75.5	71.2	1.8
2	8	20Aug96:17:00	.	1.14	16.0	16.7	4.7	8.7	2.48	2.4	0.54	0.54	2.89	3.32	0.02	0.09	0.35	0.4	1131	1094	1101	1067	80.7	79.5	74.8	73.3	4.4
2	8	20Aug96:20:00	1.82	1.70	33.0	34.0	10.0	13.0	2.7	2.76	0.54	0.54	1.98	1.87	0.16	0.02	0.4	0.39	1067	1062	924	1103	75.3	74.6	70.1	69.4	3.6
2	8	20Aug96:23:00	1.87	1.73	-1.4	3.4	2.9	1.7	2.11	1.96	0.19	0.19	3.11	3.19	0.02	0.01	0.53	0.46	1454	1449	1406	1418	88.7	87.4	83.3	82	2.7
2	8	21Aug96:02:00	0.96	1.41	1.5	3.0	1.0	3.0	2.03	1.92	0.17	0.18	3.81	3.5	0.02	0.05	0.41	0.45	1481	1485	1430	1377	89.8	87.2	83.8	81.6	1.5
2	8	21Aug96:05:00	1.05	1.05	1.2	3.2	0.8	2.0	2.58	2.41	0.23	0.22	3.77	3.59	0.05	0	0.51	0.44	1503	1483	1389	1385	95.8	94.2	89.2	88	1.7
2	8	21Aug96:08:00	1.55	2.19	4.4	4.0	1.6	3.2	2.64	2.13	0.22	0.18	4.03	4.12	0.01	0	0.42	0.43	1478	1477	1375	1398	94.4	92.7	87.5	86.2	2.1
2	8	21Aug96:11:00	2.00	1.64	18.8	19.4	9.7	6.1	2.36	1.98	0.5	0.42	3.33	3.33	0.07	0.12	0.39	0.38	1193	1475	1165	1120	82.3	82.3	76.1	76.6	2.6
2	8	21Aug96:14:00	1.73	2.82	3.0	4.5	1.5	1.0	2.42	2.43	0.23	0.25	4.18	4.19	0.06	0.1	0.5	0.43	1468	1465	1392	1403	94.6	94.1	87.8	87.2	2.9
2	8	21Aug96:17:00	2.00	2.64	4.0	0.0	2.7	0.0	1.98	2.19	0.19	0.2	3.78	3.31	0.08	0.07	0.48	0.45	1498	1515	1448	1422	92.9	93.9	87	88.2	2.4
2	8	21Aug96:20:00	0.30	1.62	5.8	5.3	1.3	1.8	2.08	2.27	0.16	0.2	2.31	2.42	0.05	0.05	0.73	0.38	1510	1523	1337	1306	84.8	84.8	80.2	79.9	2.2
2	8	21Aug96:23:00	1.32	1.37	3.5	3.5	4.0	3.0	1.41	1.75	0.13	0.13	1.78	2.13	0.06	0.05	0.37	0.42	1606	1545	807	1098	85.2	84.8	81.8	80.8	2.0
2	8	22Aug96:02:00	0.98	.	4.0	3.2	3.6	1.6	1.94	1.82	0.16	0.14	2.8	2.45	0.06	0.03	0.39	0.38	1578	1558	1332	1284	85.2	85	80.3	80.6	2.1
2	8	22Aug96:05:00	1.05	1.02	4.0	2.2	0.9	1.3	1.7	1.54	0.11	0.12	2.44	2.66	0.03	0.03	0.37	0.37	1582	1570	1328	1308	86.9	87.7	82.7	83.4	1.6
2	8	22Aug96:08:00	1.93	1.68	27.9	20.4	27.9	10.2	2.08	2.59	0.46	0.53	3.01	3.11	0.06	0.05	0.44	0.37	1346	1289	1183	1064	83.6	82	78.1	75.8	2.8
2	8	22Aug96:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	8	22Aug96:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7
2	8	22Aug96:17:00	2.12	1.29	4.0	2.4	2.0	2.0	1.89	1.77	0.14	0.17	1.85	2.16	0.04	0.06	0.52	0.47	1540	1550	749	1008	88.5	88.3	84.6	84.2	4.9
2	8	22Aug96:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.7
2	8	22Aug96:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	8	23Aug96:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	8	23Aug96:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	8	23Aug96:08:00	2.51	2.28	7.5	5.0	6.0	3.5	1.86	1.97	0.17	0.2	2.09	2.22	0.05	0.05	0.37	0.39	1503	1492	1253	1246	81.4	80.8	77.3	76.4	.
2	8	23Aug96:11:00	2.73	2.29	7.5	3.5	4.5	.	1.77	2.22	0.17	0.2	1.94	2.19	0.07	0.05	0.43	0.41	1528	1558	1319	1310	73.2	77.3	69.3	72.7	1.7
2	8	23Aug96:14:00	2.57	2.64	4.5	7.0	.	4.5	1.95	2.21	0.23	0.21	2.02	1.84	0.07	0.04	0.43	0.42	1526	1551	1191	1180	79.3	81	75.1	76.8	1.9
2	8	23Aug96:17:00	1.94	.	4.5	4.5	.	.	1.89	1.63	0.2	0.22	1.7	1.81	0.04	0.11	0.39	0.45	1562	1568	1289	1238	83	79.1	79.2	75.4	2.1
2	8	23Aug96:20:00	1.59	1.68	2.5	10.5	.	.	1.16	1.23	0.21	0.16	1.45	1.62	0.06	0.16	0.38	0.42	1547	1494	878	1272	79.5	77.9	76.7	74.9	1.7
2	8	23Aug96:23:00	1.02	1.18	6.0	7.0	4.5	6.0	1.13	1.11	0.18	0.17	1.63	1.7	0.12	0.17	0.37	0.44	1556	1559	1340	1362	77.9	78.5	75	75.5	1.5
2	8	24Aug96:02:00	1.23	1.16	5.5	6.0	3.0	5.5	1.08	1.28	0.17	0.18	1.93	2.03	0.07	0.24	0.37	0.35	1558	1568	1373	1361	78.7	78.3	75.5	74.8	1.5
2	8	24Aug96:05:00	1.37	3.46	2.0	2.0	2.0	2.7	1.18	1.42	0.17	0.18	2.07	2.18	0.09	0.14	0.37	0.34	1542	1560	1407	1365	80.2	81.1	76.8	77.3	1.4
2	8	24Aug96:08:00	2.10	2.19	9.5	9.5	7.0	6.0	1.39	1.54	0.19	0.18	2.39	2.44	0.11	0.21	0.39	0.36	1593	1585	1388	1347	83.6	82	79.6	77.8	1.3
2	8	24Aug96:11:00	2.73	2.73	7.5	8.0	2.0	4.5	1.45	1.34	0.29	0.25	2.73	2.85	0.12	0.31	0.38	0.39	1515	1553	.	1353	81.3	83.2	76.8	78.7	1.6
2	8	24Aug96:14:00	3.05	1.03	6.0	4.0	5.5	.	1.45	1.2	0.15	0.17	2.45	2.45	0.11	0.17	0.4	0.41	1603	1574	1350	1368	79.4	77.1	75.3	73.2	1.5
2	11	11Nov96:14:00	0.82	0.66	2.7	1.3	0.7	2.7	0.91	0.85	0.15	0.15	1.56	1.66	0	0	0.22	0.21	1133	1139	.	.	28.9	33.5	.	.	0.6
2	11	11Nov96:17:00	0.87	0.64	.	3.3	2.7	.	0.61	0.89	0.11	0.15	1.37	1.49	0	0	0.23	0.23	1193	1183	.	.	58.6	43.1	.	.	0.6
2	11	11Nov96:20:00	0.77	0.55	.	3.3	2.7	.	1.22	1.09	0.21	0.18	1.55	1.59	0	0.04	0.24	0.23	1164	1171	.	.	72.1	65.2	.	.	0.6
2	11	11Nov96:23:00	0.91	0.77	39.3	8.7	8.7	11.3	0.99	0.9	0.13	0.12	1.49	1.5	0	0.01	0.34	0.22	1123	1066	.	.	70.2	67.8	.	.	0.5
2	11	12Nov96:02:00	0.77	0.73	10.0	2.7	9.3	2.7	1.05	0.97	0.19	0.13	1.94	1.61	0.02	0	0.26	0.22	977	1151	.	.	65.4	70.9	.	.	0.5
2	11	12Nov96:05:00	0.68	0.87	8.0	4.0	4.0	2.0	0.99	0.96	0.14	0.15	1.71	1.59	0	0	0.23	0.25	1161	1173	.	.	73.9	68.1	.	.	0.5
2	11	12Nov96:08:00	1.09	0.73	4.7	6.0	2.0	2.7	1.04	1.07	0.25	0.26	1.7	1.89	0.01	0	0.25	0.26	1177	1191	.	.	70.7	70.2	.	.	0.6
2	11	12Nov96:11:00	0.68	0.73	4.5	6.0	1.0	2.5	1	1.15	0.22	0.24	1.82	2	0.03	0.04	0.28	0.34	1194	1183	.	.	67.7	68.8	.	.	0.5
2	11	12Nov96:14:00	0.73	0.59	.	7.3	.	3.3	1.03	0.92	0.2	0.18	1.51	1.51	0.03	0.03	0.32	0.31	1185	1170	.	.	70.1	69.1	.	.	0.6
2	11	12Nov96:17:00	0.91	0.09	9.3	10.7	2.7	6.0	1.83	1.02	0.23	0.16	1.92	1.81	0.05	0.04	0.26	0.3	1207	1188	.	.	70.8	73.1	.	.	0.6
2	11	12Nov96:20:00	0.68	0.55	4.0	4.0	2.7	2.0	1	0.94	0.18	0.18	1.73	1.46	0	0.01	0.28	0.27	1167	1074	.	.	70.2	71.6	.	.	0.5
2	11	12Nov96:23:00	0.59	0.59	3.6	3.6	2.8	3.6	1.17	0.81	0.22	0.27	1.52	1.59	0.02	0.04	0.27	0.32	1162	1138	.	.	70.9	67.3	.	.	0.5
2	11	13Nov96:02:00	0.59	0.67	4.5	2.5	3.5	0.0	0.98	0.95	0.24	0.19	1.63	1.58	0.05	0.01	0.24	0.29	1180	1164	.	.	67.8	37.6	.	.	0.6
2	11	13Nov96:05:00	0.36	0.32	2.5	1.5	3.5	1.0	0.97	0.93	0.17	0.13	1.62	1.58	0.01	0.01	0.27	0.27	1187	1093	.	.	38.9	41.9	.	.	0.5
2	11	13Nov96:08:00	0.46	0.32	3.3	4.0	1.3	2.7	1	0.9	0.14	0.15	1.66	1.82	0	0.02	0.32	0.35	1062	1022	.	.	42	45.1	.	.	0.6
2	11	13Nov96:11:00	0.91	0.82	3.5	4.5	4.0	4.5	1.08	2.31	0.14	0.17	1.65	1.65	0.01	0.03	0.31	0.3	1213	1193	.	.	61.5	58.6	.	.	0.5
2	11	13Nov96:14:00	0.73	0.91	3.5	3.5	2.0	2.0	2.29	0.7	0.32	0.12	1.45	1.26	0.04	0	0.31	0.36	1202	1037	.	.	86.1	71.5	.	.	0.6
2	11	13Nov96:17:00	1.7	1.96	6.7	7.0	3.3	4.5	1.32	1	0.16	0.12	1.41	1.44	0.02	0.04	0.32	0.28	1163	1180	.	.	72.7	74.2	.	.	0.5
2	11	13Nov96:20:00	1.14	0.87	5.3	2.0	4.0	3.3	1.07	1.87	0.13	0.21	1.36	1.46	0.03	0.03	0.28	0.34	1093	1014	.	.	72	74.6	.	.	0.5
2	11	13Nov96:23:00	1	0.49	2.7	2.0	.	3.3	1.16	1.49	0.13	0.15	1.34	1.41	0.02	0.02	0.27	0.3	1010	1153	.	.	69.4	67.6	.	.	0.5
2	11	14Nov96:02:00	0.91	0.88	4.0	3.3	1.3	4.0	1.01	0.92	0.11	0.1	1.43	1.35	0.03	0.03	0.27	0.27	1169	1187	.	.	71.8	66.1	.	.	0.5
2	11	14Nov96:05:00	1.14	0.91	3.3	0.8	2.7	2.3	1.05	2	0.11	0.22	1.48	1.55	0.04	0.05	0.3	0.29	1190	1199	.	.	64.8	65.1	.	.	0.6
2	11	14Nov96:08:00	1.73	1.41	4.7	6.0	3.3	1.3	1.04	1.43	0.12	0.18	1.7	1.75	0.04	0.03	0.31	0.26	1192	1160	.	.	65.9	65.8	.	.	0.6
2	11	14Nov96:11:00	1.28	1.25	6.0	5.3	4.0	2.7	2.28	1.38	0.21	0.21	1.58	1.5	0.03	0	0.32	0.34	1190	1218	.	.	64.8	65	.	.	0.6
2	11	14Nov96:14:00	1.23	1.55	0.7	6.7	4.7	4.0	1.07	1.09	0.13	0.12	1.54	1.67	0	0	0.26	0.22	1125	1259	.	.	66.3	70.9	.	.	0.6
2	11	14Nov96:17:00	0.93	1.05	6.0	3.3	2.7	1.3	0.87	1.19	0.12	0.12	1.21	1.54	0.03	0.01	0.29	0.29	1233	1179	.	.	70.9	69	.	.	0.5
2	11	14Nov96:20:00	1.14	1.11	4.0	5.3	1.3	0.0	1.06	1.15	0.12	0.12	1.58	1.54	0.04	0.02	0.29	0.26	1188	1164	.	.	64	49.3	.	.	0.5
2	11	14Nov96:23:00	1.04	0.87	4.0	0.7	2.7	0.7	1.13	1.01	0.11	0.15	1.53	1.54	0.01	0.03	0.25	0.28	1181	1166	.	.	44.8	48.1	.	.	0.6
2	11	15Nov96:02:00	0.67	0.67	3.3	2.0	2.0	2.0	1.11	1.7	0.13	0.18	1.26	1.45	0.04	0.01	0.33	0.3	1184	1150	.	.	46.1	44.4	.	.	0.6
2	11	15Nov96:05:00	0.73	0.9	4.7	3.3	1.3	2.0	1.26	1.07	0.11	0.09	1.63	1.55	0.03	0	0.3	0.3	1208	1191	.	.	40.4	38.1	.	.	0.6
2	11	15Nov96:08:00	1.49	1.52	7.3	7.3	0.7	10.7	1.23	1.1	0.1	0.11	1.75	1.78	0.01	0.01	0.3	0.28	1144	1193	.	.	45.5	49.1	.	.	0.6
2	11	15Nov96:11:00	1.41	1.44	5.3	4.7	5.3	0.0	1.19	1.16	0.12	0.12	1.87	1.78	0.04	0.04	0.27	0.26	1188	1188	.	.	55.4	48.4	.	.	0.6
2	11	15Nov96:14:00	2.05	1.91	5.3	8.0	4.0	2.0	1.03	1.23	0.13	0.12	1.64	1.89	0	0	0.43	0.29	1208	1180	.	.	58.9	65	.	.	0.6
2	11	15Nov96:17:00	1.37	1.21	4.0	6.0	10.0	2.7	1.19	1.24	0.12	0.11	1.77	1.87	0	0	0.28	0.28	1163	1163	.	.	63.5	64.4	.	.	0.6
2	11	15Nov96:20:00	1.43	.	6.7	.	2.7	.	1.42	.	0.12	.	1.66	.	0.01	.	0.28	.	1166	.	.	.	65.6	.	.	.	0.6
2	11	15Nov96:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
2	11	16Nov96:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
2	11	16Nov96:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	11	16Nov96:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
2	11	16Nov96:11:00	1.28	4	0.0	2.0	0.0	1.7	1.64	1.6	0.12	0.14	2.33	2.34	0.01	0.01	0.29	0.28	1069.17	1118.33	.	.	57.05	60.16	.	.	0.6
2	11	16Nov96:14:00	1.3	1.32	2.5	0.0	1.5	3.0	1.59	1.44	0.13	0.13	2.25	2.23	0.04	0.02	0.3	0.27	1070.83	1177.50	.	.	64.57	65.21	.	.	0.6
2	11	16Nov96:17:00	0.75	1.18	4.7	2.7	2.0	2.7	1.34	2.47	0.14	0.12	1.88	2.24	0	0.01	0.3	0.27	1132.50	1106.67	.	.	66.15	69.57	.	.	0.6
2	11	16Nov96:20:00	0.96	0.96	2.7	3.3	1.3	3.3	1.46	1.49	0.15	0.16	2.2	2.22	0	0.01	0.28	0.32	1123.33	1095.00	.	.	71.62	65.79	.	.	0.6
2	11	16Nov96:23:00	0.72	0.71	1.3	3.3	3.3	4.0	1.48	1.62	0.15	0.19	2.11	2.28	0.01	0.17	0.29	0.26	1154.17	1161.67	.	.	65.78	57.93	.	.	0.6
2	11	17Nov96:02:00	0.71	0.66	0.7	2.0	2.0	2.0	1.33	1.52	0.14	0.16	2.23	2.48	0.02	0.01	0.24	0.29	1185.00	1198.33	.	.	65.36	56.58	.	.	0.6
2	11	17Nov96:05:00	0.3	0.17	1.3	2.7	2.7	2.7	2.16	2.82	0.18	0.16	2.5	2.54	0.03	0	0.27	0.29	1124.17	1174.17	.	.	63.61	64.98	.	.	0.6
2	11	17Nov96:08:00	0.84	1.03	4.0	0.7	2.7	0.0	1.65	2.89	0.17	0.15	2.61	2.66	0.02	0.03	.	0.29	1198.33	1152.50	.	.	66.06	69.68	.	.	0.6
2	11	17Nov96:11:00	0.88	1.59	.	.	.	.	0.85	1.22	0.12	0.16	2.2	3.03	0.01	0.01	0.37	0.62	1026.67	1049.17	.	.	53.43	62.22	.	.	0.6
2	11	17Nov96:14:00	.	1.16	.	.	1.5	.	1.28	1.81	0.17	0.15	2.42	2.58	0	0.02	0.4	0.44	1065.83	1058.33	.	.	58.71	64.13	.	.	0.6
2	11	17Nov96:17:00	1.18	1.26	.	.	.	.	4.63	2.48	0.3	0.22	6.87	6.05	0.36	0.26	0.46	0.49	1053.33	1025.83	.	.	68.52	57.32	.	.	0.6
2	11	17Nov96:20:00	0.82	0.88	.	.	.	.	1.3	1.07	0.11	0.13	2.46	2.2	0.01	0	0.4	0.37	1062.50	1060.83	.	.	63.83	60.22	.	.	0.6
2	11	17Nov96:23:00	0.8	0.71	.	.	.	.	0.94	0.95	0.17	0.08	2.07	2.32	0.01	0.01	0.4	0.36	1053.33	1052.50	.	.	58.59	62.63	.	.	0.6
2	11	18Nov96:02:00	0.16	0.25	.	.	.	.	1.45	1.3	0.18	0.17	2.66	2.63	0.05	0.02	0.41	0.34	1042.50	1135.00	.	.	63.70	64.35	.	.	0.6
2	11	18Nov96:05:00	0.76	0.82	.	.	.	.	1.76	4.64	0.18	0.31	2.95	4.77	0.04	0	0.44	0.43	1155.83	1177.50	.	.	62.05	66.16	.	.	0.6
2	11	18Nov96:08:00	1.05	1.08	.	.	.	.	1.13	1.5	0.14	0.15	2.83	3	0	0	0.37	0.46	1135.83	1135.00	.	.	60.68	59.28	.	.	0.7
2	11	18Nov96:11:00	0.46	0.91	.	.	.	.	1.34	0.7	0.27	0.19	1.36	0.97	0	0	0.35	0.34	1044.17	1050.00	.	.	56.23	53.08	.	.	0.8
2	11	18Nov96:14:00	0.91	6.8	9.2	1.2	3.2	0.4	0.79	0.29	0.16	0.15	1.44	1.14	0	0	0.43	0.51	1086.67	1082.50	.	.	60.29	57.39	.	.	0.8
2	11	18Nov96:17:00	23.1	0.48	2.5	5.5	0.5	4.5	1.27	1.5	0.12	0.17	2.86	3.55	0	0	0.47	0.4	1101.67	1080.00	.	.	62.87	55.43	.	.	0.7
2	11	18Nov96:20:00	0.77	0.82	14.0	51.3	3.5	8.7	1.35	2.71	0.22	0.33	1.16	2.22	0.01	0.13	0.43	0.37	1060.83	1103.33	.	.	63.91	62.11	.	.	1.8
2	11	18Nov96:23:00	13.6	0.22	22.0	24.0	6.7	10.0	5.7	2.24	0.5	0.44	2.92	2.4	0.15	0.03	0.42	0.31	1025.00	618.08	.	.	60.22	31.39	.	.	4.4
2	11	19Nov96:02:00	1.08	19.5	17.3	19.3	5.3	4.0	6.15	2.89	0.69	0.58	3.45	3.03	0.13	0.02	0.39	0.45	896.67	880.00	.	.	51.70	54.99	.	.	4.8
2	11	19Nov96:05:00	23	1.14	14.7	12.0	6.7	4.0	3.3	2.28	0.64	0.51	2.69	2.81	0.02	0.01	0.38	0.31	730.75	616.50	.	.	42.52	39.62	.	.	6.1
2	11	19Nov96:08:00	0.46	0.96	17.3	18.7	4.7	9.3	4.38	3.21	0.89	0.74	4.11	3.82	0.05	0.05	0.44	0.42	824.58	553.17	.	.	56.33	36.23	.	.	8.7
2	11	19Nov96:11:00	14.2	0.82	12.0	11.0	6.0	4.0	3.74	3.87	0.75	0.77	3.57	4.53	0.13	0.13	0.46	0.44	890.00	885.00	.	.	58.78	58.50	.	.	7.7
2	11	19Nov96:14:00	0.44	0.45	6.7	8.5	2.7	4.0	5.9	2.86	0.55	0.51	2.82	2.1	0.03	0.08	0.42	0.31	986.67	566.92	.	.	54.10	31.79	.	.	6.6
2	11	19Nov96:17:00	0.43	0.57	15.0	16.0	3.5	6.7	2.95	3	0.5	0.56	2.27	2.52	0.01	0.03	0.22	0.36	911.67	908.33	.	.	58.51	57.25	.	.	6.9
2	11	19Nov96:20:00	0.59	0.36	15.3	15.3	6.0	4.0	3.32	2.76	0.6	0.52	2.33	2.46	0.02	0.01	0.24	0.22	909.17	914.17	.	.	54.48	51.32	.	.	6.8
2	11	19Nov96:23:00	0.73	0.77	11.5	13.0	3.5	5.0	2.91	2.93	0.53	0.57	2.21	2.2	0.03	0.02	0.26	0.24	896.67	907.50	.	.	58.37	67.14	.	.	6.8
2	11	20Nov96:02:00	0.84	1.09	12.5	14.0	6.0	5.0	3.27	3.19	0.75	0.74	3.43	3.55	0.01	0.04	0.26	0.22	821.42	815.17	.	.	57.88	59.11	.	.	7.6
2	11	20Nov96:05:00	1.09	1.05	8.0	10.0	4.0	3.5	3.59	3.22	0.82	0.74	3.76	3.64	0.03	0.03	0.17	0.94	800.67	803.67	.	.	59.05	61.14	.	.	7.3
2	11	20Nov96:08:00	0.89	0.96	11.5	14.0	5.0	4.5	2.67	2.46	0.61	0.56	2.98	2.78	0.03	0.01	0.26	0.23	847.50	838.33	.	.	57.68	55.72	.	.	8.2
2	11	20Nov96:11:00	0.87	0.13	12.0	11.0	2.5	4.0	2.44	2.36	0.61	0.56	3.9	3.7	0.01	0	0.22	0.16	767.67	734.25	.	.	64.08	59.11	.	.	7.9
2	11	20Nov96:14:00	0.66	0.66	6.0	5.5	5.0	2.0	1.37	1.22	0.3	0.3	0.35	0.38	0	0	0.19	0.24	944.17	951.67	.	.	56.64	53.39	.	.	6.4
2	11	20Nov96:17:00	0.77	0.82	17.0	19.0	5.5	6.5	2.63	3.62	0.39	0.6	2.42	4.27	0	0	0.15	0.17	927.50	922.50	.	.	56.52	59.13	.	.	6.9
2	11	20Nov96:20:00	0.45	0.87	19.5	16.0	6.0	4.0	4.25	4.53	0.73	0.99	3.61	6.58	0.06	0.11	0.15	0.16	890.00	841.67	.	.	61.14	60.50	.	.	7.1
2	11	20Nov96:23:00	0.15	0.77	14.5	22.5	5.0	7.0	3.28	5.11	0.48	1.05	3.4	7.28	0.07	0.06	0.15	0.16	564.00	848.33	.	.	30.99	52.33	.	.	7.3
2	11	21Nov96:02:00	0.73	0.59	28.5	25.5	7.0	6.0	3.82	3.32	0.82	0.76	7.93	7.8	0.04	0.01	0.19	0.22	777.17	722.42	.	.	55.84	59.86	.	.	8.2
2	11	21Nov96:05:00	0.73	0.87	19.0	28.0	6.5	6.5	3.48	3.39	0.78	0.81	9.42	9.71	0.08	0.1	0.2	0.18	713.92	721.42	.	.	57.64	57.45	.	.	8.1
2	11	21Nov96:08:00	0.87	0.96	31.0	25.0	9.5	7.0	3.35	3.06	0.79	0.73	7.49	5.98	0.03	0.04	0.22	0.21	750.17	753.00	.	.	58.45	57.03	.	.	7.1
2	11	21Nov96:11:00	0.35	0.68	22.5	20.5	5.5	6.0	2.59	2.3	0.51	0.44	3.59	3.17	0.04	0.04	0.24	0.17	841.67	833.33	.	.	56.69	55.72	.	.	6.9
2	13	09Jan97:14:00	1.46	.	40.0	.	12.0	.	0.7	.	0.1	.	0.7	.	0.15	.	0.39	.	950	.	.	.	58.3	.	.	.	25.1
2	13	09Jan97:17:00	1.55	.	48.8	.	14.4	.	0.1	.	0.06	.	0.37	.	0.04	.	0.26	.	925	.	.	.	45.2	.	.	.	25.7
2	13	09Jan97:20:00	0.91	.	22.4	.	4.0	.	0.26	.	0.08	.	0.41	.	0.12	.	0.19	.	803.83	.	.	.	41.5	.	.	.	25.4
2	13	09Jan97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0
2	13	10Jan97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.5
2	13	10Jan97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.2
2	13	10Jan97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.4
2	13	10Jan97:11:00	0	1.23	19.4	16.0	4.6	2.3	0.92	0.8	0.03	0.07	1.76	1.71	0.19	0.07	0.22	0.36	834.17	827.67	.	.	38	43.3	.	.	23.6
2	13	10Jan97:14:00	0.64	0.77	15.5	14.3	4.0	2.3	0.74	0.77	0.08	0.08	1.6	1.5	0.11	0.11	0.2	0.24	788.08	783.25	.	.	42.6	40.2	.	.	24.4

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	13	10Jan97:17:00	0.56	.	12.5	.	3.5	.	0.75	.	0.08	.	1.15	.	0.06	.	0.35	.	862.5	.	.	.	39.1	.	.	.	24.0
2	13	10Jan97:20:00	0.57	0.55	10.5	6.3	4.0	2.9	1.14	0.94	0.08	0.08	1.88	1.88	0.1	0.13	0.3	0.27	832.33	833.33	.	.	37	44.9	.	.	24.0
2	13	10Jan97:23:00	0.32	.	5.7	.	1.1	.	1.27	.	0.02	.	1.93	.	0.07	.	0.24	.	804.67	.	.	.	38.1	.	.	.	23.7
2	13	11Jan97:02:00	0.66	.	12.7	.	4.0	.	1.01	.	0.03	.	1.49	.	0.06	.	0.34	.	834.17	.	.	.	42.8	.	.	.	23.4
2	13	11Jan97:05:00	0.27	.	7.4	.	3.4	.	1.17	.	0.03	.	1.48	.	0.1	.	0.32	.	795.58	.	.	.	43.2	.	.	.	23.1
2	13	11Jan97:08:00	1.82	.	19.3	.	6.7	.	1.48	.	0.1	.	2.07	.	0.04	.	0.52	.	852.5	.	.	.	38.1	.	.	.	21.7
2	13	11Jan97:11:00	1.8	1.87	12.0	12.7	4.0	4.7	1.91	1.65	0.1	0.11	2.82	2.84	0	0.01	0.5	0.64	875.83	924.17	.	.	49.8	46.1	.	.	21.5
2	13	11Jan97:14:00	1.55	.	10.0	.	3.3	.	1.72	.	0.08	.	2.98	.	0.05	.	0.54	.	936.67	.	.	.	43.2	.	.	.	21.7
2	13	11Jan97:17:00	0.93	0.68	3.3	8.0	3.3	2.7	1.36	1.54	0.06	0.03	1.96	1.94	0.02	0.13	0.28	0.29	850	835	.	.	43	38.9	.	.	22.0
2	13	11Jan97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21.7
2	13	11Jan97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21.5
2	13	12Jan97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21.1
2	13	12Jan97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.8
2	13	12Jan97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.5
2	13	12Jan97:11:00	1.18	.	8.0	.	3.0	.	1.94	.	0.21	.	4.6	.	0.09	.	0.42	.	974.17	.	.	.	47.8	.	.	.	20.3
2	13	12Jan97:14:00	0.91	.	9.0	.	3.5	.	0.34	.	0.08	.	0.62	.	0.1	.	0.24	.	887.5	.	.	.	39.9	.	.	.	21.0
2	13	12Jan97:17:00	2.01	2.02	10.0	7.0	6.7	3.5	2.27	2.37	0.16	0.17	4.29	4.56	0.07	0.06	0.69	0.67	974.17	967.5	.	.	43.2	51.1	.	.	20.8
2	13	12Jan97:20:00	1.91	.	.	.	7.3	.	2.69	.	0.17	.	4.65	.	0.08	.	0.67	.	1000	.	.	.	42.5	.	.	.	20.8
2	13	12Jan97:23:00	0.82	.	12.7	.	2.7	.	2.71	.	0.16	.	4.55	.	0.08	.	0.4	.	931.67	.	.	.	50.4	.	.	.	20.6
2	13	13Jan97:02:00	0.59	0.87	13.3	0.7	0.7	2.7	3.26	2.86	0.19	0.17	5.11	5.05	0.09	0.07	0.48	0.53	992.5	948.33	.	.	42.2	49.4	.	.	20.6
2	13	13Jan97:05:00	1.09	.	4.0	.	0.7	.	2.9	.	0.16	.	4.78	.	0.06	.	0.47	.	948.33	.	.	.	52.4	.	.	.	20.4
2	13	13Jan97:08:00	1.23	.	14.7	.	2.0	.	2.83	.	0.17	.	4.87	.	0.08	.	0.62	.	980.83	.	.	.	49.8	.	.	.	20.3
2	13	13Jan97:11:00	1.41	0.91	30.0	36.7	9.3	10.0	3	2.99	0.21	0.19	5.5	5.25	0.08	0.06	0.49	0.49	974.17	973.33	.	.	41.9	49.2	.	.	20.1
2	13	13Jan97:14:00	0.82	.	32.7	.	9.3	.	3.27	.	0.23	.	5.04	.	0.07	.	0.51	.	997.5	.	.	.	47	.	.	.	20.4
2	13	13Jan97:17:00	0.73	.	32.7	.	8.7	.	3	.	0.2	.	4.6	.	0.08	.	0.42	.	968.33	.	.	.	40.5	.	.	.	20.7
2	13	13Jan97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.6
2	13	13Jan97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.5
2	13	14Jan97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.4
2	13	14Jan97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.1
2	13	14Jan97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.7
2	13	14Jan97:11:00	1.37	1.46	.	.	.	.	3.44	4.03	0.21	0.21	5.99	6.24	0.06	0.07	0.4	0.31	973.33	991.67	.	.	47.8	48.2	.	.	19.7
2	13	14Jan97:14:00	0.91	1.09	6.7	6.0	2.7	5.3	1.98	2.47	0.12	0.14	3.82	4.14	0.02	0.01	0.08	0.11	1059.2	1070	.	.	.	.	.	.	19.7
2	13	14Jan97:17:00	1	0.91	10.7	12.0	6.0	5.3	1.7	1.71	0.12	0.1	3.73	3.62	0.03	0.04	0.12	0.17	1021.7	1023.33	.	.	.	.	.	.	19.8
2	13	14Jan97:20:00	1.28	.	10.0	.	4.7	.	2.77	.	0.17	.	3.88	.	0.09	.	0.23	.	1057.5	.	.	.	.	.	.	.	19.9
2	13	14Jan97:23:00	0.73	.	6.7	.	3.3	.	2.05	.	0.12	.	3.57	.	0.01	.	0.18	.	1053.3	.	.	.	.	.	.	.	19.7
2	13	15Jan97:02:00	0.82	.	7.3	.	2.0	.	1.38	.	0.09	.	3.19	.	0	.	0.16	.	1049.2	.	.	.	.	.	.	.	19.7
2	13	15Jan97:05:00	0.82	.	7.3	.	1.3	.	2.52	.	0.14	.	4.08	.	0.02	.	0.14	.	1038.3	.	.	.	.	.	.	.	19.5
2	13	15Jan97:08:00	1.09	0.91	8.7	12.0	2.0	3.3	2.93	1.84	0.15	0.1	4.59	3.79	0.03	0.03	0.19	.	1048.3	1036.67	.	.	.	.	.	.	19.4
2	13	15Jan97:11:00	0.73	1.18	7.4	6.3	3.4	2.9	2.06	3.62	0.11	0.21	4.18	5.24	0.04	0.07	0.39	0.33	1046.7	1047.5	.	.	49.1	52.6	.	.	19.4
2	13	15Jan97:14:00	1.28	1.23	8.6	6.9	2.3	2.9	2.63	3.17	0.14	0.18	4.32	4.82	0.05	0.07	0.35	0.44	1060	1068.33	.	.	47.3	52.4	.	.	19.7
2	13	15Jan97:17:00	1.09	2.89	9.1	7.4	3.4	2.3	3.68	4.02	0.21	0.2	4.93	4.93	0.06	0.06	0.41	0.62	1058.3	1059.17	.	.	44.8	52	.	.	20.1
2	13	15Jan97:20:00	0.98	.	6.9	.	3.4	.	2.58	.	0.13	.	4	.	0.02	.	0.39	.	1080.8	.	.	.	48.3	.	.	.	20.4
2	13	15Jan97:23:00	0.1	.	6.3	.	2.3	.	3.16	.	0.17	.	4.24	.	0.05	.	0.39	.	1055.8	.	.	.	50.5	.	.	.	20.5
2	13	16Jan97:02:00	1.28	.	6.3	.	2.3	.	3.16	.	0.17	.	3.98	.	0.07	.	0.31	.	1026.7	.	.	.	48.2	.	.	.	20.4
2	13	16Jan97:05:00	0.98	.	5.7	.	2.9	.	3.82	.	0.2	.	4.52	.	0.07	.	0.34	.	1070	.	.	.	47.5	.	.	.	20.4
2	13	16Jan97:08:00	0.92	.	11.4	.	5.1	.	2.94	.	0.21	.	3.61	.	0.11	.	0.35	.	974.17	.	.	.	49.6	.	.	.	20.4
2	13	16Jan97:11:00	1.18	1.18	1.7	5.1	2.9	1.7	1.75	2.13	0.09	0.12	3.47	3.96	0.03	0.03	0.27	.	1020	.	.	.	49.3	.	.	.	20.4
2	13	16Jan97:14:00	1.18	1	7.4	6.3	1.7	1.7	1.48	3.27	0.06	0.18	2.9	3.15	0	0.04	0.41	0.42	1056.7	1058.33	.	.	52	50	.	.	21.1
2	13	16Jan97:17:00	1.18	1.18	10.3	10.9	5.1	5.1	2.53	2.67	0.11	0.13	3.59	4.01	0	0	0.44	0.48	1079.2	1071.67	.	.	49.9	56.5	.	.	22.3
2	13	16Jan97:20:00	0.46	.	7.4	.	4.6	.	1.57	.	0.07	.	3.01	.	0	.	0.51	.	1087.5	.	.	.	50	.	.	.	23.1
2	13	16Jan97:23:00	1.09	.	10.3	.	5.7	.	2.69	.	0.12	.	3.41	.	0	.	0.43	.	1086.7	.	.	.	51.9	.	.	.	22.8

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	13	17Jan97:02:00	0.55	.	5.7	.	2.9		3.77	.	0.13	.	3.18	.	0	.	0.31	.	1086.7	.	.	.	52.6	.	.	.	21.9
2	13	17Jan97:05:00	0.64	.	8.0		2.9		2.23	.	0.12	.	3.15	.	0	.	0.42	.	1098.3	.	.	.	51.2	.	.	.	21.4
2	13	17Jan97:08:00	0.91	.	6.9	.	.	.	2.94	.	0.16	.	3.72	.	0.01	.	0.42	.	1088.3	.	.	.	52.9	.	.	.	20.1
2	13	17Jan97:11:00	1	1	2.9	4.0	1.7	2.3	3.16	5.06	0.18	0.27	3.85	4.86	0	0	0.41	0.4	1120.8	1116.67	.	.	56.7	48.9	.	.	18.9
2	13	17Jan97:14:00	0.73	.	1.7	.	1.1	.	2.48	.	0.25	.	2.73	.	0.06	.	0.34	.	1120	.	.	.	55.4	.	.	.	18.7
2	13	17Jan97:17:00	0.91	0.91	3.4	4.0	1.7	1.7	1.05	4.13	0.11	0.18	2.3	2.85	0.03	0.06	0.36	0.31	1250	1100.83	.	.	46.5	52.8	.	.	19.3
2	13	17Jan97:20:00	1	1	9.1	2.3	3.4	1.1	2.7	2.53	0.16	0.16	3.65	3.7	0.04	0.04	0.43	0.51	1145.8	1130	.	.	50.9	56.4	.	.	19.5
2	13	17Jan97:23:00	0.32	.	5.7	.	1.7	.	2.83	.	0.18	.	3.62	.	0.05	.	0.4	.	1112.5	.	.	.	55.4	.	.	.	19.1
2	13	18Jan97:02:00	.	.	8.0	.	3.4	.	2.97	.	0.18	.	3.77	.	0.06	.	0.34	.	1106.7	.	.	.	55.3	.	.	.	18.0
2	13	18Jan97:05:00	.	.	6.3	8.0	13.5	3.4	2.96	2.64	0.18	0.17	3.72	3.6	0.02	0.02	0.44	0.5	1139.2	1136.67	.	.	.	50	.	.	17.4
2	13	18Jan97:08:00	.	.	6.3	.	3.4	.	3.53	.	0.19	.	3.69	.	0.05	.	0.45	.	1111.7	.	.	.	53.1	.	.	.	16.4
2	13	18Jan97:11:00	1.37	.	12.0	.	5.1		3.65	.	0.14	.	4	.	0.14	.	0.5	.	1132.5	.	.	.	51	.	.	.	15.2
2	13	18Jan97:14:00	1.18	0	6.7	1.3	4.7	2.7	3.45	0.64	0.15	0.13	3.81	3.13	0.13	0.1	0.42	0.45	1123.3	1150	.	.	49.1	52.7	.	.	15.1
2	13	18Jan97:17:00	1.09	.	4.0	.	6.0	.	2.05	.	0.16	.	2.74	.	0.18	.	0.41	.	1157.5	.	.	.	53.1	.	.	.	15.7
2	13	18Jan97:20:00	0.73	.	2.0	.	1.3		2.19	.	0.24	.	3.46	.	0.1	.	0.45	.	1155.8	.	.	.	57.9	.	.	.	15.8
2	13	18Jan97:23:00	0.68	.	2.0	.	.		3.22	.	0.18	.	3.88	.	0.14	.	0.36	.	1168.3	.	.	.	55.5	.	.	.	15.3
2	13	19Jan97:02:00	0.55	.	0.7	.	2.7	.	3.34	.	0.26	.	4.09	.	0.07	.	0.4	.	1175.8	.	.	.	49.3	.	.	.	14.6
2	13	19Jan97:05:00	0.91	1	.	.	1.3	2.0	2.67	2.6	0.17	0.19	3.81	3.8	0.11	0.06	0.37	0.36	1158.3	1141.67	.	.	59	52.5	.	.	13.8
2	13	19Jan97:08:00	0.73	0.73	.	0.7	0.7	2.0	2.58	2.59	0.18	0.17	3.89	3.82	0.07	0.11	0.37	0.3	1166.7	846.67	.	.	49.7	36.4	.	.	13.0
1	13	09Jan97:14:00	3.57	.	33.3	.	6.7	.	1.51	.	0.82	.	6.88	.	0.16	.	0.5	.	1234.2	.	.	.	68.5	.	.	.	25.4
1	13	09Jan97:17:00	3.81	.	14.0	.	5.0		1.81		1.08	.	7.94	.	0.16	.	0.49	.	1198.3	.	.	.	73.8	.	.	.	25.8
1	13	09Jan97:20:00	3.23	.	13.3	.	.	.	1.03		0.56	.	5.1	.	0.08	.	0.51	.	1203.3	.	.	.	74.5	.	.	.	26.0
1	13	09Jan97:23:00	4.25		16.0	.	29.3	.	1.36	.	0.87	.	7.3		0.1	.	0.57	.	1195	.	.	.	80.1	.	.	.	25.8
1	13	10Jan97:02:00	2.38	2.04	13.0	14.0	.	5.0	2.57	2.81	1.79	1.84	21.4	22.2	0.13	0.13	0.4	0.55	1091.7	1092.5	.	.	73.6	77.7	.	.	26.5
1	13	10Jan97:05:00	2.38	1.49	10.7	10.7	.	8.0	3.18	3.49	1.74	1.8	25.6	23.2	0.12	0.2	0.48	0.51	1135.8	1135	.	.	76.9	82.2	.	.	26.8
1	13	10Jan97:08:00	3.57	.	11.0	.	10.0		3.69	.	1.58	.	24.6		0.17	.	0.47	.	1135	.	.	.	83.8	.	.	.	26.5
1	13	10Jan97:11:00	5.61	5.91	159.3	140.6	.	.	2.7	2.92	1.32	1.33	13	13.1	0.01	0.01	0.81	0.87	1588.3	1290	.	.	.	88.8	.	.	26.2
1	13	10Jan97:14:00	21.7	13.2	230.0	208.3	35.0	70.8	1.58	1.18	0.13	0.11	1.05	0.76	0.03	0.05	1.19	1.25	1654.2	1602.5	.	.	.	97	.	.	19.8
1	13	10Jan97:17:00	27.8		270.0	.	40.0	.	1.2	.	0.12	.	0.6		0.08	.	1.22	.	1674.2	.	.	.	.	.	.	.	18.4
1	13	10Jan97:20:00	15	16.6	77.8	93.9	48.2	30.3	1.06	0.5	0.18	0.12	0.41	0.35	0.07	0.11	1.34	1.45	1689.2	1684.17	.	.	.	.	.	.	18.1
1	13	10Jan97:23:00	14.4		208.0	.	48.0	.	0.56	.	0.08	.	0.38		0.1	.	1.2	.	1708.3	.	.	.	.	.	.	.	17.8
1	13	11Jan97:02:00	20.4		227.3	.	.	.	2.01	.	0.1	.	1.27	.	0.05	.	1.29		1699.2	.	.	.		.	.	.	17.7
1	13	11Jan97:05:00	17.9	.	487.5	.	87.5	.	1.07	.	0.12	.	2.55		0.09	.	1.15	.	1680	.	.	.	.	.	.	.	17.3
1	13	11Jan97:08:00	19.3		170.0	.	46.7	.	0.93	.	0.15	.	3.65	.	0.13	.	1.27	.	1703.3	.	.	.	.	.	.	.	16.9
1	13	11Jan97:11:00	21.3	19.3	176.0	616.0	.	80.0	1.14	0.88	0.3	0.27	2.2	1.88	0.49	0.37	1.16	1.2	1681.7	1657.5	.		100	.	.	.	16.9
1	13	11Jan97:14:00	24.7		130.0	.	42.5		0.71	.	0.13	.	1.21	.	0.12	.	1.12	.	1655.8	.	.	.	.	.	.	.	17.2
1	13	11Jan97:17:00	26	29.9	637.5	380.0	87.5	0.0	3.2	2.09	0.25	0.19	1.31	1.17	0.36	0.26	1.15	1.16	1700.8	1654.17	.	.	.	.	.	.	17.3
1	13	11Jan97:20:00	21.4	.	163.3	.	33.3	.	1.03		0.26	.	4.35		0.28	.	1.17	.	1675.8	.	.	.		.	.	.	16.7
1	13	11Jan97:23:00	26.2	26.6	130.0	196.0	30.0	68.0	0.83	0.87	0.25	0.17	4.22	3.73	0.24	0.15	1.2	1.29	1660	1691.67	.	.		.	.	.	16.3
1	13	12Jan97:02:00	22.3	26.6	102.1	105.0	31.3	22.5	2.29	4.5	0.39	0.31	3.88	4.42	0.46	0.52	1.27	1.19	1647.5	1676.67	.	.	97.9	98.6	.	.	16.5
1	13	12Jan97:05:00	17.4		146.7	.	.	.	1.57	.	0.24	.	4.23	.	0.2	.	1.22	.	1615	.	.	.	98.1	.	.	.	16.4
1	13	12Jan97:08:00	23.6		145.7	.	45.7		0.89	.	0.22	.	4.55		0.14	.	1.25	.	1591.7	.	.	.	99.6	.	.	.	16.4
1	13	12Jan97:11:00	21.1		.	.	12.5		1.67	.	0.23	.	5.23	.	0.25	.	1.65	.	1739.2	.	.	.	95.2	.	.	.	16.2
1	13	12Jan97:14:00	.		25.7	.	11.4	.	1.59	.	0.19	.	4.5	.	0.21	.	1.29	.	1726.7	.	.	.	96.7	.	.		16.2
1	13	12Jan97:17:00	30.4	33.5	31.3	120.0	31.3	6.7	1.44	1.12	0.19	0.16	3.5	3.3	0.22	0.18	1.3	.	1743.3	1683.33	.	.	97.2	95	.	.	16.2
1	13	12Jan97:20:00	27.8		33.3	.	3.7	.	0.97	.	0.18	.	2.02	.	0.23	.	1.32		1762.5	.	.	.	84.3	.	.	.	16.4
1	13	12Jan97:23:00	27.3	.	29.2	.	.	.	1.21		0.21	.	5.36	.	0.16	.	1.34		1703.3	.	.	.	94.2	.	.	.	16.3
1	13	13Jan97:02:00	25.8	23.8	.	97.1	.	17.1	0.65	0.45	0.25	0.21	3.18	3.42	0.23	0.16	1.24	1.33	1737.5	1613.33	.	.	92.4	90.1	.	.	15.8
1	13	13Jan97:05:00	26.4	.	53.3	.	.	.	1.04		0.26	.	3.82		0.26	.	1.04		1655.8	.	.	.	93.3	.	.	.	16.1
1	13	13Jan97:08:00	25.2	.	112.5	.	10.0		0.77	.	0.22	.	2.79	.	0.16	.	1.12		1648.3	.	.	.	91.6	.	.	.	16.5
1	13	13Jan97:11:00	23.6	25.8	392.9	173.3	64.3	30.0	2.14	1.48	0.26	0.22	5.01	5.26	0.31	0.26	1.17	1.24	1700.8	1613.33	.	.	94.6	.	.	.	16.2

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	13	13Jan97:14:00	23.2	.	82.5	.	7.5	.	0.85	.	0.23	.	4.37	.	0.24	.	1.3	.	1630	.	.	.	80	.	.	.	16.5
1	13	13Jan97:17:00	28.7	.	151.4	.	42.9	.	1.07	.	0.13	.	2.13	.	0.12	.	1.12	.	1695.8	.	.	.	90.8	.	.	.	16.9
1	13	13Jan97:20:00	18.2	18.2	160.7	160.0	32.1	37.5	0.8	1.31	0.13	0.22	2.4	2.78	0.12	0.2	1.14	1.21	1698.3	1696.67	.	.	.	93.1	.	.	16.4
1	13	13Jan97:23:00	27.1	.	115.0	.	35.0	.	1.66	.	0.21	.	2.91	.	0.17	.	1.23	.	1708.3	.	.	.	94.1	.	.	.	16.3
1	13	14Jan97:02:00	18.7	.	123.3	.	33.3	.	1.62	.	0.26	.	5.44	.	0.15	.	1.14	.	1669.2	.	.	.	88.2	.	.	.	15.8
1	13	14Jan97:05:00	26.3	35.1	152.0	160.0	40.0	46.7	1.2	0.99	0.25	0.23	5.03	4.81	0.15	0.17	1.27	1.14	1680	1677.5	.	.	95.3	98.8	.	.	15.5
1	13	14Jan97:08:00	27.1	.	240.0	.	70.0	.	2.56	.	0.35	.	8.94	.	0.21	.	1.18	.	1673.3	.	.	.	.	.	.	.	15.3
1	13	14Jan97:11:00	22.3	27.3	146.7	112.5	53.3	45.0	0.99	1.38	0.2	0.26	10.1	10.3	0.05	0.06	1.12	1.27	1490	1415.83	.	.	.	.	.	.	15.0
1	13	14Jan97:14:00	20.3	21.7	126.7	142.4	50.0	54.6	1.1	1.23	0.21	0.26	9.62	11	0.05	0.07	1.27	1.25	1572.5	1564.17	.	.	.	.	.	.	15.1
1	13	14Jan97:17:00	23	17.9	122.9	117.7	48.6	47.1	0.89	0.54	0.19	0.13	9.04	7.44	0.05	0.02	1.34	1.27	1465	1518.33	.	.	.	.	.	.	15.0
1	13	14Jan97:20:00	26.4	.	157.1	.	48.6	.	2.12	.	0.24	.	8.68	.	0.05	.	1.28	.	1589.2	.	.	.	.	.	.	.	14.9
1	13	14Jan97:23:00	27.3	.	120.0	.	45.7	.	0.96	.	0.24	.	9.01	.	0.03	.	1.39	.	1592.5	.	.	.	.	.	.	.	15.2
1	13	15Jan97:02:00	28.1	.	136.4	.	57.6	.	1.03	.	0.27	.	8.7	.	0.07	.	1.35	.	1563.3	.	.	.	.	.	.	.	14.8
1	13	15Jan97:05:00	23.3	.	120.0	.	40.0	.	0.64	.	0.17	.	5.62	.	0.02	.	1.3	.	1581.7	.	.	.	99.4	.	.	.	15.2
1	13	15Jan97:08:00	23.6	26.2	154.3	125.0	34.3	25.0	1.99	0.63	0.21	0.17	6.42	4.69	0.09	0.05	1.36	1.26	1608.3	1588.33	.	.	.	.	.	.	15.5
1	13	15Jan97:11:00	19.6	29.3	130.0	151.4	52.5	54.3	1.47	0.84	0.26	0.13	4.79	4.11	0.19	0.04	1.27	1.3	1597.5	1599.17	.	.	.	99.3	.	.	15.8
1	13	15Jan97:14:00	21.3	23	100.0	160.0	45.0	51.4	1.78	0.82	0.16	0.12	3.9	3.43	0.06	0.05	1.26	1.3	1615.8	1592.5	.	.	.	.	.	.	15.8
1	13	15Jan97:17:00	21.1	24.1	157.1	110.0	51.4	37.5	1.76	1.34	0.33	0.3	5.45	4.59	0.05	0.1	1.41	1.41	1658.3	1724.17	.	.	.	.	.	.	15.7
1	13	15Jan97:20:00	17	.	208.0	.	76.0	.	1.08	.	0.22	.	4.36	.	0.05	.	1.39	.	1724.2	.	.	.	.	.	.	.	15.7
1	13	15Jan97:23:00	21.4	.	148.6	.	42.9	.	1.79	.	0.37	.	9.86	.	0.28	.	1.32	.	1645	.	.	.	.	.	.	.	15.6
1	13	16Jan97:02:00	15.9	.	154.3	.	54.3	.	3.19	.	0.27	.	8.53	.	0.12	.	1.04	.	1500.8	.	.	.	.	.	.	.	15.1
1	13	16Jan97:05:00	22.6	.	120.0	.	37.1	.	1.67	.	0.33	.	9.93	.	0.13	.	1.05	.	1570	.	.	.	99.3	.	.	.	14.7
1	13	16Jan97:08:00	18.5	.	171.4	.	65.7	.	1.82	.	0.33	.	10.4	.	0.1	.	1.14	.	1545	.	.	.	98.2	.	.	.	14.7
1	13	16Jan97:11:00	20.8	21.9	66.7	153.3	20.0	66.7	0.98	1.18	0.17	0.18	8.04	8.07	0.07	0.04	1.42	1.18	1559.2	1530.83	.	.	98	.	.	.	15.0
1	13	16Jan97:14:00	16	22.2	30.0	67.5	20.0	17.5	1.97	0.89	0.24	0.23	9.04	5.1	0.1	0.19	1.21	1.16	1540.8	1536.67	.	.	.	.	.	.	15.2
1	13	16Jan97:17:00	33.2	18.3	150.0	173.3	46.7	40.0	1.25	0.95	0.3	0.21	6.68	5.32	0.11	0.09	1.12	1.2	1516.7	1530.83	.	.	.	.	.	.	14.9
1	13	16Jan97:20:00	20.1	.	150.0	.	46.7	.	2.02	.	0.52	.	9.15	.	0.09	.	1.26	.	1531.7	.	.	.	.	.	.	.	14.8
1	13	16Jan97:23:00	24.7	.	212.5	.	78.1	.	1.29	.	0.21	.	3.93	.	0.07	.	1.22	.	1555.8	.	.	.	.	.	.	.	15.2
1	13	17Jan97:02:00	19.1	.	188.0	.	64.0	.	1	.	0.14	.	1.05	.	0.18	.	1.27	.	1474.2	.	.	.	.	.	.	.	14.8
1	13	17Jan97:05:00	25.9	.	200.0	.	80.8	.	0.86	.	0.14	.	0.97	.	0.14	.	1.3	.	1227.5	.	.	.	.	.	.	.	15.1
1	13	17Jan97:08:00	20.4	.	170.0	.	63.3	.	1.56	.	0.18	.	1.58	.	0.15	.	1.22	.	1471.7	.	.	.	.	.	.	.	15.1
1	13	17Jan97:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.0
1	13	17Jan97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.9
1	13	17Jan97:17:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.0
1	13	17Jan97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.9
1	13	17Jan97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.5
1	13	18Jan97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.6
1	13	18Jan97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.8
1	13	18Jan97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.0
1	13	18Jan97:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.1
1	13	18Jan97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.1
1	13	18Jan97:17:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.0
1	13	18Jan97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.6
1	13	18Jan97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.5
1	13	19Jan97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.8
1	13	19Jan97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.9
1	13	19Jan97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.8
3	13	09Jan97:14:00	0.55	.	8.0	.	2.0	.	0.57	.	0.25	.	1.62	.	0.3	.	0.11	.	713.83	.	.	.	42	.	.	.	25.2
3	13	09Jan97:17:00	0.64	.	12.5	.	2.5	.	0.44	.	0.22	.	0.86	.	0.39	.	0.45	.	669.17	.	.	.	30.5	.	.	.	25.6
3	13	09Jan97:20:00	0.27	.	7.6	.	1.6	.	0.69	.	0.24	.	1.3	.	0.37	.	0.28	.	665.75	.	.	.	33.6	.	.	.	25.4
3	13	09Jan97:23:00	0.73	.	18.0	.	5.5	.	0.59	.	0.22	.	0.92	.	0.34	.	0.39	.	655.5	.	.	.	38	.	.	.	25.6

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	13	10Jan97:02:00	1.91	2.37	54.0	50.7	14.7	10.7	0.57	0.53	0.22	0.19	0.88	1.02	0.31	0.24	0.47	0.46	697.5	666.17	.	.	38.5	37.5	.	.	25.7
3	13	10Jan97:05:00	0.46	0.36	10.8	10.8	3.2	2.0	0.75	0.44	0.19	0.1	1.56	0.7	0.22	0.14	.	0.45	.	675.42	.	.	.	38.3	.	.	25.1
3	13	10Jan97:08:00	0.55	.	6.0	.	2.0	.	0.4	.	0.14	.	1.44	.	0.18	.	0.46	.	662.25	.	.	.	33.3	.	.	.	24.8
3	13	10Jan97:11:00	1	0.68	11.6	12.8	3.2	3.2	0.54	0.71	0.17	0.18	1.19	1.39	0.21	0.22	0.41	0.24	681.83	671.92	.	.	38.3	37.1	.	.	24.7
3	13	10Jan97:14:00	0.68	0.68	9.5	11.0	5.0	4.0	0.53	0.59	0.13	0.13	1.18	1.29	0.02	0.04	.	.	655.42	658.83	.	.	31.7	32.4	.	.	23.5
3	13	10Jan97:17:00	0.91	.	9.7	.	2.9	.	1.26	.	0.13	.	1.51	.	0.04	.	0.16	.	670.25	.	.	.	37.5	.	.	.	22.8
3	13	10Jan97:20:00	1.46	1.09	10.5	12.0	3.5	5.1	0.51	0.71	0.08	0.09	0.85	0.96	0.03	0.03	0.2	0.18	707.67	736.42	.	.	36.3	40.9	.	.	22.4
3	13	10Jan97:23:00	1.37	.	16.0	.	5.7	.	0.54	.	0.09	.	0.74	.	0.02	.	0.23	.	782.75	.	.	.	39.9	.	.	.	20.9
3	13	11Jan97:02:00	0.73	.	10.0	.	2.0	.	0.4	.	0.15	.	1.64	.	0.06	.	0.2	.	706.25	.	.	.	35.7	.	.	.	19.7
3	13	11Jan97:05:00	1.09	.	14.0	.	.	.	0.44	.	0.11	.	1.23	.	0.09	.	0.2	.	758.58	.	.	.	38.7	.	.	.	22.5
3	13	11Jan97:08:00	1.28	.	15.3	.	0.0	.	0.65	.	0.07	.	0.84	.	0.06	.	0.21	.	781.25	.	.	.	43.4	.	.	.	19.6
3	13	11Jan97:11:00	3.52	3.66	15.2	15.2	6.4	3.2	0.51	0.2	0.12	0.08	0.66	0.44	0.07	0.08	0.32	0.23	823	755.67	.	.	39.3	39.7	.	.	18.6
3	13	11Jan97:14:00	3.41	.	16.0	.	3.2	.	0.24	.	0.07	.	0.3	.	0	.	0.21	.	773.83	.	.	.	39.9	.	.	.	18.1
3	13	11Jan97:17:00	3.44	3.74	16.8	15.0	4.0	3.0	0.41	-0.02	0.06	0.06	0.35	0.34	0	0.04	0.22	0.22	781.17	815.17	.	.	40.9	39.8	.	.	16.8
3	13	11Jan97:20:00	3.83	.	19.2	.	6.4	.	0.15	.	0.11	.	0.63	.	0.05	.	0.25	.	846.67	.	.	.	41.7	.	.	.	16.9
3	13	11Jan97:23:00	3.51	3.01	18.4	31.0	5.6	21.0	0.64	-0.1	0.15	0.1	1.83	0.67	0.11	0.11	0.26	0.32	831.08	847.5	.	.	42	39.9	.	.	16.7
3	13	12Jan97:02:00	3.48	3.62	14.0	15.0	6.0	7.0	0.09	0.1	0.11	0.1	0.58	0.59	0.23	0.04	0.24	0.28	850.83	795.5	.	.	41.5	41.1	.	.	16.4
3	13	12Jan97:05:00	3.72	.	16.8	.	4.0	.	0.04	.	0.08	.	0.44	.	0.09	.	0.27	.	800.67	.	.	.	46.8	.	.	.	16.2
3	13	12Jan97:08:00	4.06	.	16.0	.	8.0	.	0.28	.	0.1	.	0.72	.	0.11	.	0.27	.	789.92	.	.	.	41.1	.	.	.	16.3
3	13	12Jan97:11:00	4.56	.	26.4	.	8.8	.	0.44	.	0.09	.	0.43	.	0.12	.	0.3	.	802.58	.	.	.	34.5	.	.	.	15.9
3	13	12Jan97:14:00	3.83	.	21.6	.	4.8	.	0.53	.	0.11	.	0.72	.	0.16	.	0.27	.	865	.	.	.	44.7	.	.	.	15.9
3	13	12Jan97:17:00	2.55	3.1	11.0	25.0	1.0	9.0	0.71	0.57	0.1	0.07	1.08	1.05	0.13	0.06	0.11	0.28	793.17	836.67	.	.	47.1	37.3	.	.	17.0
3	13	12Jan97:20:00	3.46	.	42.0	.	12.0	.	1.07	.	0.12	.	1	.	0.11	.	0.29	.	849.17	.	.	.	42	.	.	.	16.3
3	13	12Jan97:23:00	3.93	.	53.0	.	16.0	.	0.96	.	0.12	.	0.87	.	0.08	.	0.28	.	849.17	.	.	.	43.7	.	.	.	16.3
3	13	13Jan97:02:00	3.74	3.83	48.0	80.0	14.0	20.0	0.69	0.71	0.08	0.08	0.4	0.5	0.08	0.08	0.33	0.31	874.17	789	.	.	38.5	44.8	.	.	16.2
3	13	13Jan97:05:00	3.93	.	38.0	.	13.0	.	0.79	.	0.13	.	0.88	.	0.06	.	0.32	.	855	.	.	.	32.2	.	.	.	15.6
3	13	13Jan97:08:00	3.28	.	14.0	.	5.0	.	0.66	.	0.13	.	0.66	.	0.06	.	0.33	.	840.83	.	.	.	37.5	.	.	.	15.6
3	13	13Jan97:11:00	2.82	4.28	20.0	13.0	6.0	1.0	0.71	0.14	0.09	0.1	0.59	0.89	0.11	0.1	0.28	0.28	835	837.5	.	.	47.4	38.6	.	.	15.6
3	13	13Jan97:14:00	4.92	.	14.0	.	4.0	.	0.66	.	0.09	.	0.9	.	0.1	.	0.26	.	850	.	.	.	40.3	.	.	.	15.6
3	13	13Jan97:17:00	2.73	.	20.0	.	6.0	.	0.45	.	0.08	.	0.98	.	0.05	.	0.26	.	829.5	.	.	.	29.6	.	.	.	15.7
3	13	13Jan97:20:00	2.73	2.73	19.0	16.0	8.0	5.0	0.56	0.6	0.07	0.08	0.43	0.41	0.07	0.09	0.29	0.43	834.17	812.83	.	.	43	43.7	.	.	15.5
3	13	13Jan97:23:00	3.1	.	19.0	.	6.0	.	1.04	.	0.1	.	0.27	.	0.11	.	0.36	.	812.92	.	.	.	41.5	.	.	.	15.6
3	13	14Jan97:02:00	3.64	0	21.0	.	6.0	.	0.76	.	0.07	.	0.75	.	0.1	.	0.31	.	833.33	.	.	.	35.9	.	.	.	15.7
3	13	14Jan97:05:00	3.01	4.92	19.0	21.0	3.0	9.0	0.89	0.52	0.1	0.08	0.72	0.85	0.08	0.09	0.34	.	833.25	.	.	.	38.6	.	.	.	15.4
3	13	14Jan97:08:00	5.01	.	22.0	.	4.0	.	0.83	.	0.05	.	0.83	.	0.06	.	0.39	.	840.83	.	.	.	42.3	.	.	.	15.0
3	13	14Jan97:11:00	2.64	4.74	26.0	24.0	4.0	6.0	0.27	0.23	0.12	0.1	1.03	0.79	0.11	0.08	0.39	0.44	840.83	837.5	.	.	32.4	41.7	.	.	14.6
3	13	14Jan97:14:00	3.69	3.48	20.0	15.0	8.0	6.0	0.34	0.6	0.11	0.12	0.63	0.7	0.09	0.14	0.44	0.45	828	838.33	.	.	34.1	37.5	.	.	14.6
3	13	14Jan97:17:00	3.46	4.02	19.0	22.0	7.0	8.0	0.39	0.21	0.11	0.11	0.51	0.53	0.13	0.09	0.49	0.54	825.33	825.67	.	.	40	36.1	.	.	14.5
3	13	14Jan97:20:00	4.28	.	20.0	.	7.0	.	0.25	.	0.1	.	0.55	.	0.12	.	0.51	.	834.17	.	.	.	38.5	.	.	.	14.3
3	13	14Jan97:23:00	3.83	.	19.0	.	7.0	.	0.57	.	0.11	.	0.65	.	0.06	.	0.48	.	836.67	.	.	.	42.5	.	.	.	14.6
3	13	15Jan97:02:00	3.69	.	17.0	.	6.0	.	0.31	.	0.11	.	0.67	.	0.04	.	0.44	.	827.92	.	.	.	42.7	.	.	.	14.6
3	13	15Jan97:05:00	4.92	.	20.0	.	9.0	.	0.31	.	0.1	.	0.75	.	0.07	.	0.34	.	805.33	.	.	.	42.2	.	.	.	14.9
3	13	15Jan97:08:00	4.46	5.47	14.0	17.0	4.0	8.0	0.43	0.83	0.11	0.13	0.9	1.26	0.1	0.07	0.42	0.39	811.67	805.92	.	.	37.7	42.8	.	.	14.8
3	13	15Jan97:11:00	5.56	3.74	22.0	17.0	10.0	7.0	0.37	0.85	0.1	0.12	0.75	1.08	0.13	0.07	0.35	0.48	812.67	816.42	.	.	41.5	40.8	.	.	14.8
3	13	15Jan97:14:00	4.65	3.95	22.0	22.0	7.0	7.0	0.98	0.76	0.13	0.09	0.84	0.8	0	0.03	0.49	0.53	844.17	829.83	.	.	44.6	41.9	.	.	14.8
3	13	15Jan97:17:00	4.46	6.63	18.0	15.0	7.0	5.0	0.75	0.73	0.1	0.07	0.63	0.91	0.03	0.03	0.42	0.36	819.33	826.25	.	.	39.8	41.1	.	.	14.7
3	13	15Jan97:20:00	3.37	.	23.0	.	6.0	.	0.33	.	0.04	.	0.57	.	0.03	.	0.37	.	841.67	.	.	.	43.1	.	.	.	14.7
3	13	15Jan97:23:00	3.44	.	18.0	.	6.0	.	0.49	.	0.06	.	0.73	.	0.03	.	0.35	.	821.25	.	.	.	43.4	.	.	.	14.2
3	13	16Jan97:02:00	3.57	.	19.0	.	7.0	.	0.53	.	0.06	.	0.63	.	0.01	.	0.36	.	835.83	.	.	.	41.7	.	.	.	14.3
3	13	16Jan97:05:00	3.06	.	15.0	.	4.0	.	0.73	.	0.09	.	1.1	.	0.01	.	0.33	.	834.17	.	.	.	45.7	.	.	.	14.1
3	13	16Jan97:08:00	3.95	.	10.0	.	5.0	.	0.35	.	0.06	.	0.61	.	0.03	.	0.45	.	802.67	.	.	.	39.7	.	.	.	14.2

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	13	16Jan97:11:00	0.08	0.16	7.0	17.0	7.0	8.0	0.7	0.39	0.09	0.06	0.76	0.63	0.02	0.04	0.6	0.54	837.5	836.67	.	.	43	40.8	.	.	14.4
3	13	16Jan97:14:00	0.1	0.04	18.0	15.0	7.0	7.0	1.05	0.24	0.1	0.11	0.94	0.84	0.03	0.09	0.51	0.39	834.17	843.33	.	.	40.3	40.7	.	.	14.4
3	13	16Jan97:17:00	0.11	0.12	21.0	24.0	8.0	8.0	0.27	0.74	0.11	0.12	0.69	0.61	0.09	0.13	0.38	0.4	828.92	815	.	.	43.8	43.8	.	.	14.9
3	13	16Jan97:20:00	0.05	.	26.0	.	7.0	.	0.26	.	0.06	.	0.48	.	0	.	0.47	.	849.17	.	.	.	41.6	.	.	.	14.4
3	13	16Jan97:23:00	4.08	.	61.0	.	14.0	.	0.22	.	0.15	.	0.87	.	.	.	0.78	.	882.5	.	.	.	47.4	.	.	.	13.8
3	13	17Jan97:02:00	2.93	.	19.0	.	8.0	.	0.58	.	0.11	.	0.59	.	0	.	0.45	.	859.17	.	.	.	46	.	.	.	13.5
3	13	17Jan97:05:00	4.08	.	26.0	.	8.0	.	.	.	0.11	.	0.61	.	0.12	.	0.69	.	868.33	.	.	.	45.5	.	.	.	13.1
3	13	17Jan97:08:00	4.08	.	21.0	.	4.0	.	0.29	.	0.09	.	0.56	.	0.12	.	0.56	.	850	.	.	.	44.9	.	.	.	13.3
3	13	17Jan97:11:00	4.59	4.21	26.0	24.0	7.0	7.0	0.53	0.52	0.1	0.09	0.53	0.63	0.12	0.24	0.55	0.54	797.25	859.17	.	.	53.3	41.1	.	.	12.8
3	13	17Jan97:14:00	3.64	.	50.0	.	14.0	.	1.61	.	0.17	.	1.24	.	0.03	.	0.71	.	849.17	.	.	.	44.7	.	.	.	13.1
3	13	17Jan97:17:00	3.01	2.37	20.0	54.0	7.0	17.0	0.74	0.71	0.11	0.08	0.6	0.46	0	0.02	0.49	0.43	839.17	845.83	.	.	45.4	44.4	.	.	13.2
3	13	17Jan97:20:00	3.1	3.64	52.0	49.0	15.0	16.0	0.45	1.72	0.07	0.09	0.53	0.64	0.02	0.02	0.43	0.47	839.17	873.33	.	.	47	48.2	.	.	13.1
3	13	17Jan97:23:00	3.01	.	44.0	.	13.0	.	0.4	.	0.05	.	0.49	.	0.02	.	0.45	.	890.83	.	.	.	50.9	.	.	.	12.7
3	13	18Jan97:02:00	3.74	.	44.0	.	16.0	.	0.5	.	0.04	.	0.54	.	0.02	.	0.43	.	919.17	.	.	.	51.3	.	.	.	11.4
3	13	18Jan97:05:00	3.74	4.24	.	39.0	0.0	16.0	0.66	0.69	0.06	0.08	0.64	0.79	0.02	0.01	0.44	0.57	902.5	909.17	.	.	42.1	45.9	.	.	10.8
3	13	18Jan97:08:00	4.42	.	46.0	.	15.0	.	0.78	.	0.07	.	0.78	.	0.01	.	0.44	.	936.67	.	.	.	45.4	.	.	.	10.5
3	13	18Jan97:11:00	4.46	3.44	120.0	69.0	31.0	21.0	0.94	0.73	0.15	0.08	1.73	0.91	0.02	0	0.43	0.44	932.5	1003.33	.	.	45.4	46.2	.	.	9.6
3	13	18Jan97:14:00	2.04	3.99	30.0	28.0	9.0	8.0	0.59	0.58	0.1	0.1	0.73	0.77	0.09	0.07	0.41	0.39	1135.8	1255	.	.	50.3	47	.	.	9.9
3	13	18Jan97:17:00	3.99	.	19.0	.	5.0	.	0.59	.	0.1	.	0.77	.	0.08	.	0.4	.	958.33	.	.	.	43.7	.	.	.	10.9
3	13	18Jan97:20:00	3.19	.	38.0	.	12.0	.	0.45	.	0.09	.	0.68	.	0.12	.	0.4	.	916.67	.	.	.	47.1	.	.	.	11.9
3	13	18Jan97:23:00	2.55	.	12.0	.	5.0	.	0.41	.	0.12	.	0.84	.	0.06	.	0.38	.	1158.3	.	.	.	50.2	.	.	.	11.7
3	13	19Jan97:02:00	3.51	.	21.0	.	8.0	.	0.22	.	0.1	.	0.69	.	0.11	.	0.43	.	1162.5	.	.	.	42.3	.	.	.	11.1
3	13	19Jan97:05:00	4.07	2.07	15.0	18.0	7.0	5.0	0.43	0.55	0.1	0.1	0.75	0.81	0.1	0.09	0.46	0.68	943.33	1155	.	.	45.1	42.9	.	.	11.2
3	13	19Jan97:08:00	4.15	3.83	15.0	14.0	5.0	2.0	0.75	0.62	0.11	0.13	0.74	0.95	0.08	0.09	0.46	0.42	979.17	891.67	.	.	42.9	37.7	.	.	11.3
3	13	19Jan97:11:00	3.51	.	14.0	.	5.0	.	0.48	.	0.12	.	0.97	.	0.09	.	0.38	.	1075.8	.	.	.	46.2	.	.	.	10.7
2	17	11May97:14:00	0.55	.	68.6	.	14.3	.	0.81	.	0.09	.	1.2	.	0.08	.	0.3	.	949.17	.	.	.	70.7	.	.	.	27.7
2	17	11May97:17:00	2.73	0.6	72.1	68.6	17.1	17.1	0.63	0.57	0.04	0.07	0.35	0.27	0	0.01	0.34	0.26	936.67	920.83	.	.	61.2	55	.	.	27.5
2	17	11May97:20:00	0.28	.	60.7	.	13.6	.	0.65	.	0.01	.	0.31	.	0	.	0.27	.	960.83	.	.	.	53.5	.	.	.	28.1
2	17	11May97:23:00	0.25	.	55.7	.	15.0	0.0	0.72	.	0.14	.	0.62	.	0	.	0.33	.	975.83	.	.	.	57.1	.	.	.	28.2
2	17	12May97:02:00	0.4	0.41	60.7	62.1	15.0	15.7	0.61	0.54	0.04	0.07	0.63	0.25	0	0	0.22	0.87	925.83	935.83	.	.	51.7	64.8	.	.	28.1
2	17	12May97:05:00	0.64	.	72.1	.	17.9	.	0.66	.	0.1	.	1.16	.	0	.	0.57	.	905	.	.	.	50	.	.	.	28.1
2	17	12May97:08:00	0.77	0.55	64.3	70.0	14.3	13.6	0.78	0.6	0.06	0.06	2.48	0.62	0.03	0.01	0.37	0.31	906.67	883.33	.	.	60.6	50.1	.	.	28.1
2	17	12May97:11:00	0.49	0.5	19.0	26.9	5.0	8.0	1.12	1.65	0.11	0.03	3.08	2.06	0.04	0	0.27	0.61	901.67	945.83	.	.	57.2	59.3	.	.	28.1
2	17	12May97:14:00	0.82	0.73	30.3	29.1	8.0	5.1	0.63	0.6	0.02	0	2.09	0.55	0	0	0.36	0.28	850.83	815.08	.	.	51.7	44.6	.	.	28.3
2	17	12May97:17:00	0.64	.	28.6	.	5.7	.	1.24	.	0.17	.	1.72	.	0.03	.	0.3	.	845.83	.	.	.	50.7	.	.	.	28.4
2	17	12May97:20:00	0.55	.	13.7	.	1.7	.	0.51	.	0	.	1.04	.	0	.	0.31	.	879.17	.	.	.	51.3	.	.	.	28.2
2	17	12May97:23:00	0.46	.	12.6	.	0.0	.	0.98	.	0.02	.	0.83	.	0	.	0.26	.	923.33	.	.	.	52.9	.	.	.	28.1
2	17	13May97:02:00	0.36	0.46	15.4	10.3	1.7	1.7	0.96	0.96	0.32	0.1	1.9	1.42	0.01	0.02	0.31	0.41	897.5	894.17	.	.	49.8	48.4	.	.	27.2
2	17	13May97:05:00	0.55	0.27	29.7	25.7	3.4	6.9	0.81	0.73	0.07	0.06	0.68	0.56	0.01	0	0.68	0.26	914.17	910	.	.	48.6	44.3	.	.	26.9
2	17	13May97:08:00	0.5	.	29.1	.	5.1	.	0.67	.	0.07	.	0.43	.	0	.	0.22	.	990	.	.	.	48.5	.	.	.	26.8
2	17	13May97:11:00	0.41	.	22.3	.	3.4	.	0.66	.	0.11	.	0.61	.	0	.	0.31	.	993.33	.	.	.	56.2	.	.	.	26.8
2	17	13May97:14:00	0.36	0.36	3.3	8.0	4.0	1.3	0.7	0.57	0.11	0.07	0.55	0.47	0	0	0.27	0.3	1029.2	1013.33	.	.	54.7	51.9	.	.	26.7
2	17	13May97:17:00	0.41	0.41	10.7	15.4	2.7	2.3	1.72	0.66	0.25	0.08	0.89	0.43	0	0	0.3	0.3	1020	1034.17	.	.	50.6	51	.	.	26.9
2	17	13May97:20:00	0.22	0.28	16.0	10.3	1.7	1.1	1.29	0.87	0.08	0.11	0.31	0.64	0	0.01	0.26	0.24	983.33	928.33	.	.	46.7	49.8	.	.	27.1
2	17	13May97:23:00	0.36	.	13.7	.	1.7	.	1.44	.	0.09	.	0.58	.	0.02	.	0.26	.	969.17	.	.	.	50.7	.	.	.	27.0
2	17	14May97:02:00	0.31	.	14.3	.	2.9	.	1.32	.	0.15	.	0.62	.	0.02	.	0.27	.	1000.8	.	.	.	53.9	.	.	.	27.0
2	17	14May97:05:00	0.28	.	12.6	.	1.1	.	1.78	.	0.23	.	0.71	.	0.05	.	0.25	.	939.17	.	.	.	47.5	.	.	.	27.1
2	17	14May97:08:00	0.24	.	26.3	.	2.9	.	1.39	.	0.12	.	0.48	.	0.01	.	0.31	.	910	.	.	.	44.8	.	.	.	27.3
2	17	14May97:11:00	0.55	.	22.3	.	3.4	.	1.6	.	0.22	.	0.81	.	0.07	.	0.3	.	948.33	.	.	.	49.5	.	.	.	27.2
2	17	14May97:14:00	0.55	0.59	24.6	23.4	0.6	4.0	1.23	1.63	0.12	0.12	0.72	0.71	0.03	0	1.94	0.54	873.33	870	.	.	48.8	46.8	.	.	27.4
2	17	14May97:17:00	0.64	.	18.3	.	2.9	.	1.69	.	0.58	.	1.5	.	0.03	.	0.61	.	877.5	.	.	.	47.9	.	.	.	27.4

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	17	14May97:20:00	0.5	.	17.1	.	0.6	.	0.59		0.5	.	0.61		0.01	.	0.6	.	1000.8	.	.	.	45.8	.	.	.	27.3
2	17	14May97:23:00	0.28	.	20.0	.	-1.1	.	1.54	.	0.12	.	1.33	.	0	.	0.57	.	975	.	.	.	44.1	.	.	.	27.3
2	17	15May97:02:00	0.26	.	9.1	.	-7.4	.	1.43	.	0.1	.	1.4	.	0.02	.	0.6	.	964.17	.	.	.	46.5	.	.	.	27.3
2	17	15May97:05:00	0.46	0.5	6.9	12.6	-2.3	-0.6	1.64	1.44	0.08	0.26	1.14	2.06	0.01	0.01	0.69	0.75	975.83	977.5	.	.	50	48.8	.	.	27.3
2	17	15May97:08:00	0.32	0.36	14.9	24.6	1.7	3.4	1.26	1.73	0.12	0.15	2.29	2.24	0.01	0	0.85	0.92	1023.3	1008.33	.	.	53.9	51.2	.	.	27.2
2	17	15May97:11:00	0.73	.	8.0	.	-0.6	.	1.92	.	0.03	.	1.6	.	0	.	0.97	.	1025	.	.	.	53.9	.	.	.	27.1
2	17	15May97:14:00	0.64	0.73	9.0	11.5	2.5	3.0	0.86	1.55	0.25	0.06	3.3	2.1	0.02	0	1.15	1.21	1081.7	1021.67	.	.	52	57.5	.	.	27.2
2	17	15May97:17:00	0.82	0.82	10.0	15.0	3.0	4.0	1.79	1.55	0.18	0.07	2.01	2.15	0	0.01	1.22	1.17	1080	1062.5	.	.	51.9	52.1	.	.	27.2
2	17	15May97:20:00	0.82	.	11.5	.	11.0	.	1.15	. .	0.13		2.16		0	.	1.17	.	1108.3	.	.	.	53.5	.	.	.	27.2
2	17	15May97:23:00	0.96	0.91	18.5	16.0	5.5	5.0	1.42	1.79	0.11	0.25	1.78	2.21	0.02	0.01	1.13	1.13	1139.2	1107.5	.	.	56.1	53.5	.	.	27.2
2	17	16May97:02:00	0.73	.	21.0	.	5.0	.	1.58	.	0.07	.	1.72	.	0	.	1.09	.	1138.3	.	.	.	51.6	.	.	.	27.1
2	17	16May97:05:00	1	.	7.5	.	4.0	.	1.93	.	0.03	.	1.33	.	0.02	.	1.23	.	1130.8	.	.	.	51.5	.	.	.	27.1
2	17	16May97:08:00	0.91	.	20.0	.	6.5	.	1.46	.	0.21	.	2.3	.	0.04	.	1.21	.	1135	.	.	.	59.2	.	.	.	27.1
2	17	16May97:11:00	1.05	.	21.0	.	9.0	.	0.95	.	0.18	.	2.77	.	0.01	.	1.22	.	1138.3	.	.	.	53.8	.	.	.	27.0
2	17	16May97:14:00	1.11	1.05	11.5	10.0	2.0	3.5	1.64	1.46	0.1	0.13	2.16	2.78	0.02	0.03	0.34	0.45	1082.5	1092.5	.	.	47.8	52.9	.	.	27.0
2	17	16May97:17:00	1.09	1.37	10.0	11.5	3.5	0.5	3.26	1.92	0.33	0.24	3.81	2.79	0.09	0.05	0.49	0.48	1114.2	1091.67	.	.	53.6	59.3	.	.	27.3
2	17	16May97:20:00	0.96	.	22.5	.	2.0	.	1.83	.	0.06	.	1.55	.	0.04	.	0.43	.	1090	.	.	.	56.6	.	.	.	27.1
2	17	16May97:23:00	1.18	.	18.5	.	-1.0	.	1.42	.	0.11	.	1.53	.	0.03	.	0.51	.	1145.8	.	.	.	54.6	.	.	.	27.0
2	17	17May97:02:00	0.94	1.18	12.0	32.5	1.5	4.5	1.86	1.41	0.1	0.13	1.72	2.44	0.04	0.01	0.6	0.64	1101.7	1101.67	.	.	57.1	54.2	.	.	27.0
2	17	17May97:05:00	1	.	16.0	.	1.5	.	1.43	.	0.13	.	2.07	.	0.01	.	0.52	.	1125.8	.	.	.	55.2	.	.	.	27.0
2	17	17May97:08:00	1.18	.	21.0	.	2.0	.	1.47	.	0.09	.	2.2	.	0.04	.	0.53	.	1109.2	.	.	.	59.4	.	.	.	27.0
2	17	17May97:11:00	1.68	.	13.5	.	3.0	.	1.52	.	0.13	.	2.42	.	0.04	.	0.58	.	1085.8	.	.	.	54.4	.	.	.	26.9
2	17	17May97:14:00	1.46	1.73	15.0	15.5	4.5	3.5	1.49	1.97	0.26	0.15	3.04	1.98	0	0.02	1.17	1.15	1148.3	1159.17	.	.	58.3	62	.	.	26.9
2	17	17May97:17:00	2.1	.	13.5	.	2.5	.	1.57	.	0.11	.	1.48	.	0.02	.	1.19	.	1159.2	.	.	.	61.5	.	.	.	27.0
2	17	17May97:20:00	1.64	.	14.0	.	4.0	.	1.99	.	0.27	.	1.28	.	0.02	.	1.21	.	1167.5	.	.	.	55.6	.	.	.	27.0
2	17	17May97:23:00	0.18	.	16.5	.	5.0	.	1.07	.	0.2	.	1.09	.	0.02	.	1.03	.	1204.2	.	.	.	53.3	.	.	.	26.9
2	17	18May97:02:00	1.18	1	42.0	15.0	13.0	6.0	1.45	1.64	0.08	0.07	0.59	0.54	0.03	0.01	1.01	1.12	1200.8	1241.67	.	.	56.1	53.8	.	.	27.2
2	17	18May97:05:00	2	1.64	12.5	15.0	5.0	6.0	1.46	1.78	0.14	0.09	1.69	1.12	0.01	0.02	1.16	1.11	1198.3	1175	.	.	54	56.2	.	.	27.0
2	17	18May97:08:00	2.37	.	19.5	.	5.5	.	1.99	.	0.21	.	1.21	.	0.02	.	1.18	.	1183.3	.	.	.	56.5	.	.	.	26.8
2	17	18May97:11:00	2.73	.	13.5	.	5.5	.	0.9	.	0.16	.	1.25	.	0	.	1.17	.	1165.8	.	.	.	54.5	.	.	.	26.8
2	17	18May97:14:00	3.46	.	7.0	.	6.0	.	1.44	.	0.18	.	1.62	.	0	.	1.17	.	1178.3	.	.	.	54.3	.	.	.	27.0
2	17	18May97:17:00	0.82	.	11.5	.	4.0	.	0.66	.	0.05	.	0.2	.	0	.	0.29	.	1059.2	.	.	.	54.3	.	.	.	27.2
2	17	18May97:20:00	2	1.64	3.0	12.0	1.0	3.0	1.06	1.07	0.22	0.23	2.28	2.46	0.01	0	0.47	0.53	1090	1089.17	.	.	58.3	61.3	.	.	27.2
2	17	18May97:23:00	3.1	3.19	10.0	10.0	4.5	3.0	0.72	0.84	0.06	0.38	0.2	0.64	0	0.05	0.53	0.63	1107.5	1131.67	.	.	56.5	61.3	.	.	26.9
2	17	19May97:02:00	2.37	.	20.5	.	7.5	.	0.68	.	0.15	.	0.59	.	0.01	.	0.47	.	1088.3	.	.	.	58.7	.	.	.	26.9
2	17	19May97:05:00	0.46	0.77	7.0	16.5	3.0	3.0	0.61	0.55	0.16	0.09	0.9	0.55	0	0	0.28	0.26	1001.7	957.5	.	.	51.1	50.9	.	.	27.7
2	17	19May97:08:00	0.68	.	9.0	.	8.0	.	0.71	.	0.23	.	1.47	.	0	.	0.24	.	994.17	.	.	.	51.1	.	.	.	27.8
2	17	19May97:11:00	4.74	.	5.5	.	3.5	.	0.8	.	0.14	.	1.34	.	0	.	0.58	.	1114.2	.	.	.	57.7	.	.	.	27.0
2	17	19May97:14:00	2.55	4.37	10.5	14.3	8.0	4.0	1.58	1.42	0.14	0.12	0.8	0.82	0.01	0.05	0.68	0.7	1183.3	1157.5	.	.	56.5	58.1	.	.	27.0
2	17	19May97:17:00	0.59	.	21.5	.	5.5	.	1.42	.	0.09	.	1.21	.	0.03	.	0.34	.	1000.8	.	.	.	53.1	.	.	.	27.8
2	17	19May97:20:00	0.41	.	10.5	.	1.5	.	1.3	.	0.08	.	0.79	.	0.02	.	0.32	.	1000.8	.	.	.	51.2	.	.	.	28.2
2	17	19May97:23:00	3.55	4.74	6.0	12.3	1.5	8.5	1.12	0.6	0.14	0.14	.	0.27	0.01	0	0.69	0.63	1168.3	1142.5	.	.	58	56.6	.	.	27.1
2	17	20May97:02:00	4.28	3.46	11.5	14.6	8.5	8.5	1.31	1.25	0.09	0.13	.	0.5	0.03	0.03	0.63	0.69	1191.7	1151.67	.	.	55.7	56.4	.	.	27.0
2	17	20May97:05:00	4.92	.	24.6	.	11.5	.	1.21	.	0.09	.	0.54	.	0.04	.	0.9	.	1188.3	.	.	.	57.6	.	.	.	26.9
2	17	20May97:08:00	4.92	.	19.2	.	10.8	.	1.24	.	0.11	.	0.3	.	0.02	.	0.82	.	1183.3	.	.	.	59.6	.	.	.	26.9
2	17	20May97:11:00	1.69	.	20.8	.	12.3	.	0.9	.	0.1	.	0.46	.	0.08	.	0.67	.	1106.7	.	.	.	61.7	.	.	.	27.0
2	17	20May97:14:00	4.92	.	11.0	.	4.5	.	0.95	.	0.26	.	1.47	.	0.02	.	0.66	.	940	.	.	.	61.4	.	.	.	27.1
2	17	20May97:17:00	0.55	0.73	7.5	6.5	2.0	3.0	1.2	1.38	0.15	0.06	0.42	0.26	0.01	0	0.21	0.25	799.5	796.5	.	.	50.6	50.8	.	.	28.2
2	17	20May97:20:00	0.46	.	7.0	.	1.0	.	1.47	.	0.06	.	0.94	.	0.02	.	0.23	.	778.17	.	.	.	49.4	.	.	.	28.3
2	17	20May97:23:00	4.46	.	10.0	.	5.0	.	1.18	.	0.09	.	0.54	.	0.01	.	0.63	.	946.67	.	.	.	58.5	.	.	.	27.6
2	17	21May97:02:00	4.74	6.38	16.0	13.0	4.0	2.0	1.61	1.36	0.12	0.2	0.6	0.5	0	0.02	0.61	0.71	1048.3	1116.67	.	.	57.7	62	.	.	27.0

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	17	21May97:02:00	4.74	6.38	16.0	13.0	4.0	2.0	1.61	1.36	0.12	0.2	0.6	0.5	0	0.02	0.61	0.71	1048.3	1116.67	.	.	57.7	62	.	.	27.0
2	17	21May97:05:00	5.92	6.38	12.0	10.0	5.0	6.0	1.14	1.18	0.06	0.13	0.11	0.54	0	0	0.72	0.75	1102.5	1018.33	.	.	60.1	59.6	.	.	27.0
2	17	21May97:08:00	6.38	.	19.0	.	3.0	.	1.15	.	0.09	.	0.26	.	0.02	.	0.69	.	1060.8		.	.	57.8	.	.	.	26.9
2	17	21May97:11:00	7.29	.	18.0	.	4.0	.	1.1	.	0.09	.	0.45	.	0	.	0.89	.	1077.5		.	.	54.3	.	.	.	26.9
1	17	11May97:14:00	10.6	.	245.0	.	60.0	.	.	.	.	.	.	.	.	.	1.07	.	1757.5	.	.	.	90.2	.	.	.	29.4
1	17	11May97:17:00	7.65	9.25	247.5	265.0	47.5	52.5	.	1.25	.	0.15	0.52	0.45	0.05	0.06	1.06	.	1771.7	.	.	.	87.3	.	.	.	30.5
1	17	11May97:20:00	7.23	.	227.5	.	57.5	.	0.41	.	0.18	.	0.47	.	0.05	.	.	.	.	.	.	.	.	.	.	.	30.8
1	17	11May97:23:00	6.38	.	232.5	.	52.5	.	0.79	.	0.17	.	0.71	.	0.03	.	.	.	.	.	.	.	.	.	.	.	31.1
1	17	12May97:02:00	5.74	5.42	247.5	247.5	47.5	42.5	1.2	1.4	0.06	0.03	0.29	0.26	0	0	.	.	.	.	.	.	.	.	.	.	31.4
1	17	12May97:05:00	4.15	.	302.5	.	62.5	.	0.91	.	0.11	.	0.71	.	0.02	.	.	.	.	.	.	.	.	.	.	.	31.5
1	17	12May97:08:00	4.88	4.59	218.0	210.0	44.0	48.0	1.33	0.62	0.05	0.26	0.84	2.38	0.02	.	.	.	.	.	.	.	.	.	.	.	31.6
1	17	12May97:11:00	0.32	2.87	290.0	270.0	67.5	67.5	1.21	0.86	0.08	0.11	1.37	1.5	0	0.04	.	.	.	.	.	.	.	.	.	.	31.7
1	17	12May97:14:00	2.44	2.81	27.0	31.0	10.0	9.0	0.53	0.94	0.05	0.29	0.43	1.11	0.01	0	1.05	0.92	1565	1650.83	.	.	82.7	77.5	.	.	32.1
1	17	12May97:17:00	3.06	.	29.0	.	9.0	.	1.12	.	0.18	.	0.85	.	0.02	.	0.9	.	1502.5	.	.	.	76.7	.	.	.	32.2
1	17	12May97:20:00	2.42	.	28.0	.	9.3	.	1.22	.	0.03	.	0.24	.	0	.	0.94	.	1482.5	.	.	.	76.2	.	.	.	32.2
1	17	12May97:23:00	1.29	.	32.0	.	10.7	.	1.03	.	0.06	.	0.76	.	0	.	0.93	.	1394.2	.	.	.	74.5	.	.	.	30.9
1	17	13May97:02:00	1.85	0.91	13.3	14.7	1.3	6.7	0.6	0.74	0.16	0.24	1.61	1.95	0	0	0.44	0.34	1324.2	1294.17	.	.	69.9	71.2	.	.	31.0
1	17	13May97:05:00	1.59	1.51	10.7	14.7	9.3	1.3	1.46	1.11	0.3	0.12	1.49	1.45	0	0	0.25	0.27	1319.2	1317.5	.	.	67.8	64.7	.	.	31.3
1	17	13May97:08:00	1.79	.	16.0	.	1.3	.	1.21	.	0.14	.	1.87	.	0	.	1.09	.	1310	.	.	.	71.9	.	.	.	31.0
1	17	13May97:11:00	0.22	.	26.7	.	6.7	.	1.35	.	0.16	.	1.38	.	0.02	.	0.34	.	1322.5	.	.	.	68.7	.	.	.	30.9
1	17	13May97:14:00	2.3	0.96	25.7	25.7	8.0	8.0	0.93	1.05	0.2	0.16	1.95	2.08	0	0.01	0.15	0.17	1046.7	1099.17	.	.	85.1	86.2	.	.	31.4
1	17	13May97:17:00	0.73	0.44	14.9	21.3	5.1	4.0	1.52	0.62	0.22	0.38	1.67	3.48	0	0.03	0.09	0.11	1007.5	989.17	.	.	74.9	77.3	.	.	31.6
1	17	13May97:20:00	1.02	0.96	15.3	10.0	2.0	0.7	0.67	0.73	0.38	0.41	3.39	3.68	0	0	0.21	0.17	985.83	995	.	.	78.9	82	.	.	31.6
1	17	13May97:23:00	0.8	.	9.3	.	0.0	.	0.76	.	0.4	.	3.52	.	0	.	0.18	.	1039.2	.	.	.	80.7	.	.	.	31.5
1	17	14May97:02:00	1.05	.	14.4	.	2.4	.	0.8	.	0.38	.	4.02	.	0	.	0.13	.	1085	.	.	.	84.1	.	.	.	29.9
1	17	14May97:05:00	4.19	.	12.0	.	0.8	.	1.26	.	0.67	.	2.79	.	0.17	.	0.79	.	1334.2	.	.	.	82.2	.	.	.	27.5
1	17	14May97:08:00	7.2	.	44.0	.	8.0	.	0.39	.	0.15	.	0.45	.	0.02	.	1.08	.	1527.5	.	.	.	105	.	.	.	28.0
1	17	14May97:11:00	5.42	.	34.0	.	4.0	.	0.98	.	0.18	.	0.9	.	0.05	.	1.13	.	1480	.	.	.	99.8	.	.	.	27.7
1	17	14May97:14:00	3.83	3.28	34.0	32.0	12.0	10.0	1.32	0.87	0.07	0.07	0.89	0.19	0.05	0.03	1.14	1.21	1536.7	1532.5	.	.	98.9	100	.	.	27.9
1	17	14May97:17:00	8.16	.	20.0	.	12.0	.	0.9	.	0.08	.	0.59	.	0	.	1.11	.	1559.2	.	.	.	107	.	.	.	28.0
1	17	14May97:20:00	5	.	16.0	.	10.0	.	0.96	.	0.07	.	0.45	.	0.06	.	1.24	.	1545.8	.	.	.	106	.	.	.	28.0
1	17	14May97:23:00	9.25	.	54.3	.	5.7	.	1.24	.	0.13	.	2.13	.	0.07	.	1.03	.	1589.2	.	.	.	112	.	.	.	27.9
1	17	15May97:02:00	6.67	.	12.5	.	2.5	.	1.4	.	0.36	.	1.94	.	0.06	.	1.05	.	1564.2	.	.	.	104	.	.	.	27.4
1	17	15May97:05:00	5.83	4.56	122.0	24.0	40.0	12.0	1.1	0.73	0.01	0.03	0.13	0.07	0.07	0.02	1.11	1.12	1635	1603.33	.	.	100	95.1	.	.	27.1
1	17	15May97:08:00	0	7.29	44.0	30.0	22.0	12.0	1.22	0.72	0.32	0.07	1.65	0.46	0.12	0	1.15	1.16	1613.3	1640	.	.	99.9	111	.	.	27.2
1	17	15May97:11:00	4.46	.	128.9	.	35.6	.	1.02	.	0.13	.	0.5	.	0	.	1.18	.	1587.5	.	.	.	112	.	.	.	27.2
1	17	15May97:14:00	.	6.8	.	28.9	.	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27.2
1	17	15May97:17:00	5.92	7.84	28.0	35.0	14.0	25.0	1.07	1.47	0.21	0.11	0.63	0.73	.	0.04	0.47	0.46	1929.2	1900.83	.	.	84.9	95.3	.	.	27.3
1	17	15May97:20:00	7.31	.	28.9	.	24.4	.	1.41	.	0.12	.	0.37	.	0.03	.	0.48	0.58	1885.8	1880.83	.	.	94	97.2	.	.	27.5
1	17	15May97:23:00	4.37	7.29	46.7	46.7	35.6	22.2	1.5	1.83	0.03	0.11	0.13	0.5	0.03	0.07	0.52	.	1900	.	.	.	92.8	.	.	.	26.5
1	17	16May97:02:00	8.16	.	25.0	.	25.0	.	1.57	.	0.07	.	0.3	.	0.03	.	0.85	1.05	1895.8	1930.83	.	.	94.2	89.8	.	.	26.4
1	17	16May97:05:00	7.65	.	31.1	.	24.4	.	1.4	.	0.04	.	0.27	.	0	.	1.03	.	1917.5	.	.	.	94.2	.	.	.	26.8
1	17	16May97:08:00	4.56	.	46.7	.	28.9	.	0.92	.	0.19	.	0.64	.	0.06	.	0.64	.	1900.8	.	.	.	92.8	.	.	.	26.8
1	17	16May97:11:00	7.47	.	66.7	.	37.8	.	1.18	.	0.14	.	0.71	.	0.1	.	0.65	.	1975.8	.	.	.	91.7	.	.	.	26.8
1	17	16May97:14:00	.	8.29	40.0	37.1	17.1	11.4	2.44	0.9	0.5	0.1	5.46	0.43	.	0.03	0.64	.	1930	.	.	.	93.1	.	.	.	26.5
1	17	16May97:17:00	8.5	7.87	45.0	48.6	15.0	25.7	0.78	0.81	0.06	0.07	0.27	0.37	0.02	0.02	0.65	0.56	1884.2	1974.17	.	.	92	93.3	.	.	26.4
1	17	16May97:20:00	8.72	.	68.6	.	31.4	.	1.05	.	0.28	.	0.91	.	0.06	.	0.53	0.43	1930	1905	.	.	95.5	96.6	.	.	26.6
1	17	16May97:23:00	5.74	.	45.7	.	20.0	.	1.33	.	0.28	.	2.55	.	0.08	.	0.56	.	1913.3	.	.	.	90.6	.	.	.	26.6
1	17	17May97:02:00	8.5	7.87	28.6	31.4	17.1	20.0	1.24	1.15	0.19	0.05	0.61	0.48	0.09	0.06	0.59	0.59	1905	1940	.	.	97	96.8	.	.	26.4
1	17	17May97:05:00	7.23	.	45.7	.	25.7	.	0.88	.	0.06	.	0.29	.	0.03	.	0.6	.	1900	.	.	.	95.4	.	.	.	26.4
1	17	17May97:08:00	8.5	.	37.1	.	20.0	.	0.93	.	0.13	.	0.68	.	0.14	.	0.59	.	1945.8	.	.	.	87.7	.	.	.	26.2

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	17	17May97:11:00	8.29	.	65.7	.	31.4	.	0.73	.	0.17	.	0.77	.	0.18	.	0.52	.	1938.3	.	.	.	86.5	.	.	.	25.9
1	17	17May97:14:00	9.14	8.83	240.0	42.9	67.5	11.4	1.07	1.1	0.25	0.24	0.85	0.75	0.11	0.1	0.51	0.49	1905.8	1869.17	.	.	88.6	89	.	.	26.3
1	17	17May97:17:00	8.5	.	34.3	.	0.0	.	1.22	.	0.08	.	0.36	.	0.09	.	0.51	.	1916.7	.	.	.	86.1	.	.	.	26.6
1	17	17May97:20:00	8.2	.	34.3	.	2.9	.	0.73	.	0.07	.	0.33	.	0.07	.	0.48	.	1790	.	.	.	85.8	.	.	.	26.6
1	17	17May97:23:00	7.87	.	31.4	.	2.9	.	1	.	0.03	.	0.21	.	0.11	.	0.51	.	1782.5	.	.	.	87.2	.	.	.	26.5
1	17	18May97:02:00	9.78	5.1	22.9	14.3	2.9	0.0	0.78	1.92	0.06	0.15	0.47	0.35	0.06	0.15	0.5	0.47	1786.7	1770.83	.	.	92	105	.	.	26.1
1	17	18May97:05:00	9.14	10.6	40.0	77.1	11.4	17.1	1.86	1.64	0.07	0.08	0.09	0.38	0.05	0.06	0.49	0.43	1822.5	1814.17	.	.	107	105	.	.	25.8
1	17	18May97:08:00	13.5	.	37.1	.	5.7	.	1.74	.	0.07	.	0.04	.	0.03	.	0.45	.	1793.3	.	.	.	94.2	.	.	.	25.8
1	17	18May97:11:00	5.31	.	168.6	.	51.4	.	1.58	.	0.21	.	0.55	.	0.2	.	0.43	.	1813.3	.	.	.	105	.	.	.	26.0
1	17	18May97:14:00	5.31	.	37.1	.	5.7	.	1.61	.	0.09	.	0.29	.	0	.	1.05	.	1677.5	.	.	.	106	.	.	.	26.1
1	17	18May97:17:00	9.99	.	22.9	.	8.6	.	1.66	.	0.05	.	1.06	.	0	.	1.27	.	1736.7	.	.	.	111	.	.	.	26.2
1	17	18May97:20:00	9.17	11.1	20.0	28.6	0.0	0.0	1.98	1.8	0.43	0.05	0.19	3.18	0.37	0	1.27	1.25	1773.3	1654.17	.	.	108	106	.	.	26.6
1	17	18May97:23:00	5.31	8.93	31.4	28.6	0.0	2.9	2.17	1.82	0.35	0.05	0.18	2.21	0.25	0	1.16	1.12	1690.8	1545.83	.	.	103	105	.	.	26.5
1	17	19May97:02:00	8.5	.	20.0	.	2.9	.	1.9	.	0.06	.	0.13	.	0	.	1.14	.	1650.8	.	.	.	113	.	.	.	26.6
1	17	19May97:05:00	8.29	9.14	20.0	77.1	5.7	5.7	1.49	2.19	0.06	0.17	0.33	3.53	0	0	1.19	1.18	1678.3	1616.67	.	.	105	109	.	.	26.5
1	17	19May97:08:00	7.87	.	40.0	.	0.0	.	1.89	.	0.09	.	0.63	.	0	.	1.22	.	1560	.	.	.	104	.	.	.	26.4
1	17	19May97:11:00	8.29	.	34.3	.	11.4	.	2.31	.	0.13	.	0.62	.	0.05	.	1.2	.	1740	.	.	.	112	.	.	.	26.5
1	17	19May97:14:00	6.48	12.5	65.7	51.4	22.9	8.6	1.09	0.9	0.02	0.02	0.56	0.67	0.05	0.03	1.36	1.44	1655.8	1700.83	.	.	118	111	.	.	26.7
1	17	19May97:17:00	9.48	.	48.6	.	11.4	.	1.21	.	0.03	.	0.81	.	0.04	.	1.32	.	1718.3	.	.	.	99.1	.	.	.	26.8
1	17	19May97:20:00	9.99	.	34.3	.	2.9	.	0.68	.	0.06	.	0.99	.	0.01	.	1.3	.	1818.3	.	.	.	113	.	.	.	26.8
1	17	19May97:23:00	11.9	9.57	57.1	42.9	14.3	14.3	0.85	0.72	0.02	0.01	0.42	0.6	0.02	0.02	1.23	1.14	1798.3	1684.17	.	.	110	111	.	.	26.8
1	17	20May97:02:00	10.8	12	31.4	20.0	20.0	11.4	1.23	0.94	0.22	0.14	1.15	1.77	0.05	0.02	1.26	1.3	1775.8	1756.67	.	.	117	122	.	.	26.7
1	17	20May97:05:00	10.4	.	45.7	.	17.1	.	1.01	.	0.05	.	1.02	.	0	.	1.24	.	1765.8	.	.	.	105	.	.	.	26.6
1	17	20May97:08:00	9.97	.	157.1	.	37.1	.	0.83	.	0.06	.	0.7	.	0.02	.	1.27	.	1679.2	.	.	.	116	.	.	.	26.7
1	17	20May97:11:00	12.1	.	162.9	.	45.7	.	1.36	.	0.13	.	0.53	.	0.02	.	1.4	.	1740	.	.	.	109	.	.	.	27.0
1	17	20May97:14:00	11.3	.	54.3	.	42.9	.	0.4	.	0.04	.	0.44	.	0	.	0.38	.	1660	.	.	.	91.6	.	.	.	27.2
1	17	20May97:17:00	5.95	8.5	48.6	40.0	37.1	28.9	0.32	1.31	0.05	0.03	0.85	0.59	0	0	0.39	0.4	1688.3	1681.67	.	.	87.3	85.3	.	.	27.5
1	17	20May97:20:00	9.35	.	44.0	.	22.0	.	0.88	.	0.04	.	0.62	.	0.03	.	0.34	.	1687.5	.	.	.	88.3	.	.	.	27.7
1	17	20May97:23:00	6.59	.	30.0	.	20.0	.	0.7	.	0.07	.	0.99	.	0	.	0.27	.	1702.5	.	.	.	86.4	.	.	.	27.7
1	17	21May97:02:00	8.93	8.93	40.0	24.0	22.0	20.0	1.3	1.26	0.1	0.1	1.2	1.7	0.06	0.1	0.23	0.22	1670.8	1659.17	.	.	86.2	84.5	.	.	27.6
1	17	21May97:05:00	7.65	5.53	24.0	22.0	16.0	16.0	1.16	1.55	0.14	0.08	1.72	1.18	0	0.02	0.52	0.54	1664.2	1625.83	.	.	86.1	75.7	.	.	27.1
1	17	21May97:08:00	12.1	.	116.0	.	40.0	.	0.73	.	0.05	.	0.75	.	0.01	.	0.25	.	1599.2	.	.	.	77.1	.	.	.	27.0
1	17	21May97:11:00	9.57	.	34.0	.	22.0	.	0.52	.	0.08	.	0.75	.	0	.	1.04	.	1514.2	.	.	.	95.8	.	.	.	27.4
3	17	11May97:14:00	0.2	.	67.9	.	15.7	.	0.97	.	0.18	.	1.13	.	0.02	.	0.24	.	840	.	.	.	45.9	.	.	.	31.0
3	17	11May97:17:00	0.34	0.31	70.7	42.5	14.3	6.1	0.87	1.19	0.18	0.12	1.44	0.95	0.01	0.02	0.19	0.21	788.08	762.17	.	.	46.2	43.9	.	.	32.1
3	17	11May97:20:00	0.46	.	36.4	.	7.5	.	1.22	.	0.11	.	0.55	.	0.02	.	0.23	.	795.25	.	.	.	45.6	.	.	.	31.6
3	17	11May97:23:00	0.37	.	47.0	.	11.7	.	0.76	.	0.14	.	0.6	.	0.01	.	0.22	.	776.75	.	.	.	41.2	.	.	.	31.4
3	17	12May97:02:00	0.33	0.41	47.0	36.1	11.3	6.1	1.23	0.27	0.15	0.21	0.7	1.24	0.03	0	0.19	0.22	771.75	749.25	.	.	42.1	37.6	.	.	31.8
3	17	12May97:05:00	0.64	.	38.8	.	5.4	.	1.54	.	0.14	.	1.12	.	0	.	0.24	.	768.58	.	.	.	39.8	.	.	.	32.0
3	17	12May97:08:00	0.64	0.71	75.7	69.3	20.7	16.4	1.13	1.45	0.22	0.21	1.44	1.27	0.01	0	0.24	0.22	776	749.5	.	.	40.1	39.8	.	.	32.0
3	17	12May97:11:00	0.5	0.46	46.7	37.5	7.1	10.4	1.25	0.88	0.2	0.24	1.52	1.18	0	0	0.23	0.2	759.25	746.92	.	.	42.2	39.4	.	.	32.1
3	17	12May97:14:00	0.47	0.38	12.7	10.0	4.0	3.3	1.54	1.13	0.23	0.25	1.52	2.91	0.02	0.05	0.15	0.18	700.17	669.08	.	.	52.7	50.7	.	.	32.2
3	17	12May97:17:00	0.33	.	9.3	.	2.0	.	1.11	.	0.22	.	1.47	.	0	.	0.24	.	712.58	.	.	.	52.7	.	.	.	32.0
3	17	12May97:20:00	0.24	.	8.0	.	1.1	.	1.37	.	0.11	.	1.02	.	0.02	.	0.23	.	703.5	.	.	.	49.3	.	.	.	31.5
3	17	12May97:23:00	0.44	.	7.4	.	1.7	.	1.07	.	0.14	.	1.44	.	0	.	0.2	.	665.08	.	.	.	48.3	.	.	.	31.1
3	17	13May97:02:00	0.48	0.64	7.4	8.6	2.3	1.7	1.07	1.34	0.22	0.21	2.01	1.3	0.01	0.02	0.28	0.29	681.92	669.33	.	.	51.5	53.2	.	.	29.7
3	17	13May97:05:00	0.53	0.46	25.7	25.1	8.6	6.3	1.32	1.48	0.15	0.14	1.2	1.36	0	0.01	0.3	0.29	639.42	629.17	.	.	49.2	49.5	.	.	30.1
3	17	13May97:08:00	0.5	.	13.7	.	3.4	.	0.99	.	0.2	.	1.34	.	0	.	0.21	.	631	.	.	.	51.8	.	.	.	30.5
3	17	13May97:11:00	0.46	.	9.7	.	1.7	.	0.86	.	0.19	.	1.27	.	0	.	0.19	.	657.5	.	.	.	47.8	.	.	.	30.7
3	17	13May97:14:00	0.1	0.19	9.7	8.0	2.3	1.0	1.51	1.45	0.11	0.15	0.8	0.98	0	0.01	0.2	0.25	646.5	641.25	.	.	48.9	47.2	.	.	30.8
3	17	13May97:17:00	0.26	0.26	9.5	8.0	0.5	0.0	1.35	1.17	0.24	0.17	1.82	1.11	0.01	0	0.22	0.21	633.92	621.58	.	.	50.7	47.6	.	.	31.0

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	17	13May97:20:00	0.24	0.17	8.5	7.5	1.0	0.0	1.05	1.49	0.17	0.21	1.07	1.05	0	0.01	0.21	0.21	644.25	631.25	.	.	48.6	48.2	.	.	31.0
3	17	13May97:23:00	2.24	.	9.0	.	1.5	.	1.12	.	0.33	.	2.49	.	0	.	0.21	.	646.25	.	.	.	50	.	.	.	31.0
3	17	14May97:02:00	1.62	.	7.5	.	2.0	.	1.21	.	0.31	.	2.51	.	0	.	0.25	.	684	.	.	.	52.8	.	.	.	30.7
3	17	14May97:05:00	0.14	.	8.6	.	1.7	.	1.46	.	0.19	.	1.98	.	0.01	.	0.29	.	677.25	.	.	.	51.1	.	.	.	30.5
3	17	14May97:08:00	0.18	.	8.6	.	2.3	.	0.87	.	0.26	.	2.88	.	0.01	.	0.26	.	662.58	.	.	.	51.9	.	.	.	30.6
3	17	14May97:11:00	0.38	.	10.0	.	1.5	.	1.21	.	0.21	.	2.47	.	0	.	0.24	.	674.08	.	.	.	57.5	.	.	.	30.6
3	17	14May97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30.6
3	17	14May97:17:00	0.31	.	11.5	.	3.0	.	1.95	.	0.22	.	1.86	.	0.06	.	0.28	.	782.67	.	.	.	41.1	.	.	.	30.9
3	17	14May97:20:00	0.32	.	4.5	.	2.0	.	2.28	.	0.33	.	2.8	.	0	.	0.29	.	772.75	.	.	.	43.5	.	.	.	30.9
3	17	14May97:23:00	0.28	.	15.5	.	4.5	.	.	.	.	.	.	.	.	.	0.26	.	780.75	.	.	.	42.5	.	.	.	30.8
3	17	15May97:02:00	0.16	.	11.0	.	4.0	.	1.38	.	0.12	.	1.63	.	0	.	0.23	.	777.33	.	.	.	43	.	.	.	30.9
3	17	15May97:05:00	0.27	0.31	10.0	9.5	2.5	2.5	1.01	.	0.17	.	1.94	.	0.01	.	0.24	0.24	769.83	764.75	.	.	41.2	39	.	.	30.9
3	17	15May97:08:00	0.3	0.37	10.0	5.5	3.5	2.0	1.29	0.66	0.15	0.18	1.65	2.32	0.01	0	0.25	0.21	774.58	768.92	.	.	40.2	44	.	.	30.9
3	17	15May97:11:00	0.16	.	9.0	.	2.0	.	1.09	.	0.14	.	1.59	.	0	.	0.29	.	764.08	.	.	.	42	.	.	.	30.9
3	17	15May97:14:00	0.56	0.6	6.0	7.5	2.0	1.5	0.81	1.14	0.14	0.17	2	1.79	0	0	0.25	0.16	771.17	763.33	.	.	41.3	41	.	.	30.9
3	17	15May97:17:00	0.39	0.15	8.5	8.0	2.5	2.5	0.93	0.56	0.13	0.21	1.75	2.23	0	0	0.18	0.23	772.33	767.08	.	.	40.9	43.3	.	.	30.9
3	17	15May97:20:00	0.26	.	6.0	.	1.3	.	1.35	.	0.16	.	1.33	.	0	.	0.21	.	776.75	.	.	.	39	.	.	.	31.0
3	17	15May97:23:00	0	0.5	7.5	8.0	2.0	3.0	0.78	1.2	0.14	0.16	1.83	1.74	0	0	0.27	0.24	785.92	784.83	.	.	41	42.1	.	.	30.9
3	17	16May97:02:00	0.56	.	9.5	.	4.0	.	1.02	.	0.11	.	1.67	.	0.01	.	0.25	.	787.5	.	.	.	38.5	.	.	.	30.8
3	17	16May97:05:00	0.19	.	10.5	.	4.0	.	1.19	.	0.15	.	2.2	.	0	.	0.25	.	790.75	.	.	.	43.4	.	.	.	30.8
3	17	16May97:08:00	0.35	.	9.0	.	3.0	.	0.82	.	0.14	.	2.06	.	0	.	0.25	.	795.67	.	.	.	43.2	.	.	.	30.9
3	17	16May97:11:00	0.29	.	6.5	.	2.5	.	0.79	.	0.14	.	1.72	.	0.02	.	0.3	.	812.08	.	.	.	43.9	.	.	.	30.8
3	17	16May97:14:00	0.01	0.14	6.4	6.0	1.6	0.8	0.78	1.17	0.15	0.13	1.69	1.48	0.01	0	0.3	0.24	715.25	711.75	.	.	49	48.1	.	.	30.8
3	17	16May97:17:00	0.27	0.24	6.0	7.6	0.8	1.6	1.42	1.37	0.22	0.12	1.86	2.17	0.11	0.15	0.2	0.22	720.17	718.67	.	.	48.6	49.2	.	.	30.8
3	17	16May97:20:00	0.41	.	6.4	.	1.6	.	0.93	.	0.15	.	2	.	0.03	.	0.27	.	789.5	.	.	.	53.2	.	.	.	30.7
3	17	16May97:23:00	0.29	.	11.2	.	2.4	.	0.84	.	0.17	.	2.35	.	0.01	.	0.22	.	762.67	.	.	.	51.1	.	.	.	30.6
3	17	17May97:02:00	0.41	0.38	10.0	11.6	1.6	2.8	0.89	0.98	0.21	0.2	2.82	3.22	0.03	0.03	0.25	0.28	759.5	743.83	.	.	49.7	53.3	.	.	30.5
3	17	17May97:05:00	0.41	.	18.8	.	4.0	.	1.25	.	0.13	.	2.81	.	0.03	.	0.28	.	755.5	.	.	.	52.6	.	.	.	30.5
3	17	17May97:08:00	0.4	.	8.4	.	1.6	.	1.11	.	0.21	.	4.24	.	0.01	.	0.23	.	765.67	.	.	.	49	.	.	.	30.4
3	17	17May97:11:00	0.32	.	8.8	.	1.2	.	1.24	.	0.21	.	3	.	0	.	0.21	.	782.08	.	.	.	51.3	.	.	.	30.3
3	17	17May97:14:00	0.27	0.36	8.5	7.5	0.0	0.0	1.13	0.99	0.24	0.28	3.84	4.82	0	0	0.22	0.25	760.58	762.25	.	.	53.3	56.2	.	.	30.1
3	17	17May97:17:00	0.46	.	7.0	.	1.5	.	1.31	.	0.27	.	2.86	.	0	.	0.21	.	780.75	.	.	.	48.6	.	.	.	30.1
3	17	17May97:20:00	0.27	.	6.8	.	1.6	.	1.27	.	0.24	.	3.03	.	0	.	0.23	.	767.42	.	.	.	52.5	.	.	.	30.2
3	17	17May97:23:00	0.46	.	12.4	.	2.4	.	1.14	.	0.17	.	2.54	.	0	.	0.27	.	772.17	.	.	.	50.5	.	.	.	30.2
3	17	18May97:02:00	0.36	0.19	15.2	21.6	4.0	6.0	0.92	1.22	0.25	0.22	3.91	3.56	0	0.01	0.29	0.26	779.25	751.5	.	.	53.3	54.4	.	.	30.3
3	17	18May97:05:00	0.29	0.38	18.4	13.6	4.8	3.2	1.12	1.23	0.22	0.24	3.9	4	0.02	0.02	0.25	0.25	772.08	764.42	.	.	53.9	54.4	.	.	30.2
3	17	18May97:08:00	0.09	.	10.4	.	3.2	.	1.39	.	0.16	.	3.38	.	0.02	.	0.25	.	747.75	.	.	.	49.1	.	.	.	30.2
3	17	18May97:11:00	0.32	.	9.6	.	3.2	.	1.2	.	0.22	.	3.5	.	0.03	.	0.24	.	768.33	.	.	.	52.8	.	.	.	30.1
3	17	18May97:14:00	0.29	.	8.4	.	3.2	.	1.08	.	0.24	.	4.46	.	0.01	.	0.27	.	732.08	.	.	.	55.1	.	.	.	30.2
3	17	18May97:17:00	5.14	.	6.0	.	1.6	.	1.09	.	0.28	.	4.61	.	0.03	.	0.24	.	748.92	.	.	.	52.9	.	.	.	30.3
3	17	18May97:20:00	0.46	0.32	4.4	3.6	1.6	0.8	1.42	1.23	0.25	0.34	3.45	2.98	0.02	0.02	0.29	0.3	836.67	835	.	.	53.9	60.7	.	.	30.1
3	17	18May97:23:00	0.46	0.53	11.6	13.0	2.8	4.0	0.94	0.96	0.25	0.17	2.92	3.2	0.02	0.01	0.35	0.36	824.83	817.92	.	.	56.4	62.5	.	.	30.0
3	17	19May97:02:00	0.26	.	12.0	.	3.2	.	1.63	.	0.49	.	3.98	.	0.13	.	0.35	.	811.33	.	.	.	61.1	.	.	.	30.1
3	17	19May97:05:00	0.17	0.25	6.0	6.0	0.0	1.2	0.95	1.28	0.28	0.19	5.2	3.78	0	0.01	0.26	0.28	702.08	732.25	.	.	61.3	66.5	.	.	30.2
3	17	19May97:08:00	0.33	.	5.2	.	0.8	.	0.98	.	0.29	.	5.27	.	0.02	.	0.32	.	740.08	.	.	.	56.3	.	.	.	30.1
3	17	19May97:11:00	0.41	.	9.0	.	3.0	.	0.61	.	0.33	.	6.2	.	0	.	0.32	.	734.17	.	.	.	56.3	.	.	.	30.1
3	17	19May97:14:00	0.31	0.13	6.5	8.5	.	0.5	0.6	0.61	0.23	0.19	5.67	5.4	0.01	0.02	0.28	0.3	727.83	722.5	.	.	60	58.8	.	.	30.1
3	17	19May97:17:00	0.27	.	7.0	.	1.0	.	0.44	.	0.23	.	2.89	.	0	.	0.3	.	769.42	.	.	.	54	.	.	.	30.3
3	17	19May97:20:00	0.27	.	6.5	.	0.0	.	0.45	.	0.22	.	3	.	0	.	0.31	.	764.42	.	.	.	56.3	.	.	.	30.3
3	17	19May97:23:00	0.47	0.42	10.4	9.2	1.2	2.4	0.61	0.53	0.2	0.2	3.15	3.72	0.01	0.01	0.34	0.32	797.83	795.92	.	.	54.5	55.9	.	.	30.2
3	17	20May97:02:00	0.36	0.38	14.4	14.4	1.2	2.8	0.64	0.63	0.16	0.17	3.53	3.94	0.02	0.01	0.3	0.32	781.42	793.17	.	.	52.5	56.3	.	.	30.0

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	17	20May97:05:00	0.46	.	20.0	.	3.6	.	0.51	.	0.22	.	4.8	.	0.01	.	0.37	.	793.17	.	.	.	59.6	.	.	.	30.0
3	17	20May97:08:00	0.41	.	8.8	.	0.6	.	0.57	.	0.21	.	4.99	.	0.02	.	0.34	.	801.75	.	.	.	55.9	.	.	.	30.1
3	17	20May97:11:00	0.46	.	10.5	.	1.0	.	1.06	.	0.26	.	4.45	.	0	.	0.3	.	796.33	.	.	.	55.4	.	.	.	30.0
3	17	20May97:14:00	0.31	.	6.0	.	0.8	.	1.19	.	0.19	.	2.96	.	0	.	0.27	.	776.92	.	.	.	54.9	.	.	.	30.1
3	17	20May97:17:00	0.31	0.27	6.8	10.8	0.8	3.2	1.35	0.81	0.18	0.31	2.52	4.01	0	0.04	0.26	0.24	789.08	798.75	.	.	52.4	56.6	.	.	30.2
3	17	20May97:20:00	0.2	.	6.0	.	0.8	.	0.7	.	0.37	.	4.13	.	0.01	.	0.23	.	.	.	.	.	52.3	.	.	.	30.3
3	17	20May97:23:00	0.33	.	10.0	.	4.4	.	0.99	.	0.27	.	3.95	.	0.02	.	0.28	.	.	.	.	.	52.5	.	.	.	30.3
3	17	21May97:02:00	0.13	0.25	10.4	8.4	3.6	2.4	1.13	1.15	0.22	0.2	3.54	3.39	0	0.01	0.31	0.26	.	.	.	.	54.6	54	.	.	30.2
3	17	21May97:05:00	0.13	0.33	9.5	8.8	4.0	1.2	1.04	1.74	0.21	0.09	3.98	2.93	0	0.06	0.3	0.32	.	.	.	.	53.9	54.8	.	.	30.2
3	17	21May97:08:00	0.41	.	11.5	.	4.5	.	1.18	.	0.17	.	3.67	.	0.01	.	0.33	.	.	.	.	.	58.1	.	.	.	30.1
3	17	21May97:11:00	0.35	.	8.5	.	3.0	.	1.11	.	0.21	.	4.21	.	0.01	.	0.25	.	.	.	.	.	52.3	.	.	.	30.1
2	20	2Aug97:14:00	1.28	1.28	7.4	5.1	4.6	2.9	0.93	0.84	0.12	0.18	1.98	2.23	0.05	0.02	0.39	0.37	1397.5	1300	.	.	64.1	62.2	.	.	1.0
2	20	2Aug97:17:00	1.09	1.05	5.1	5.1	2.3	2.3	0.81	0.78	0.16	0.14	2.5	1.77	0.05	0.02	0.46	0.42	1380.8	1302.5	.	.	68.4	64.7	.	.	1.0
2	20	2Aug97:20:00	0.91	0.91	4.6	4.6	2.3	2.3	0.85	0.85	0.17	0.18	2.2	2.26	0.01	0.04	0.43	0.36	1376.7	1337.5	.	.	68.4	65.5	.	.	1.0
2	20	2Aug97:23:00	0.73	.	4.0	.	1.7	.	0.81	.	0.17	.	1.69	.	0	.	0.35	.	1326.7	.	.	.	63.2	.	.	.	1.0
2	20	3Aug97:02:00	0.36	.	4.0	.	2.9	.	0.89	.	0.18	.	2.06	.	0.03	.	0.33	.	1319.2	.	.	.	64.6	.	.	.	1.0
2	20	3Aug97:05:00	0.41	.	2.9	.	2.3	.	1.26	.	0.42	.	2.79	.	0.09	.	0.32	.	1382.5	.	.	.	64.5	.	.	.	1.0
2	20	3Aug97:08:00	0.64	.	3.4	.	2.3	.	1.32	.	0.18	.	2.18	.	0.02	.	0.31	.	1387.5	.	.	.	69.7	.	.	.	1.0
2	20	3Aug97:11:00	0.96	1.55	4.6	5.7	3.4	2.3	0.8	0.85	0.2	0.19	2.13	2.15	0.02	0.01	0.33	0.36	1410	1280	.	.	70	71.1	.	.	1.0
2	20	3Aug97:14:00	0.91	1.14	4.0	3.4	2.9	2.9	0.98	0.81	0.32	0.18	2.39	2.18	0.02	0	0.52	0.5	1329.2	1322.5	.	.	69.6	65.4	.	.	1.0
2	20	3Aug97:17:00	0.91	1	4.6	5.0	2.9	2.5	0.78	1.09	0.15	0.2	1.85	2.68	0	0	0.54	0.52	1356.7	1320.83	.	.	64.1	64.3	.	.	1.1
2	20	3Aug97:20:00	0.82	.	3.5	.	2.5	.	0.76	.	0.16	.	1.96	.	0.01	.	0.44	.	1370	.	.	.	68.1	.	.	.	1.0
2	20	3Aug97:23:00	0.77	.	1.5	.	2.5	.	0.69	.	0.16	.	1.79	.	0.01	.	0.45	.	1419.2	.	.	.	72.6	.	.	.	1.0
2	20	4Aug97:02:00	0.68	.	1.0	.	3.0	.	0.75	.	0.17	.	1.97	.	0.02	.	0.66	.	1329.2	.	.	.	71.2	.	.	.	1.0
2	20	4Aug97:05:00	0.59	.	1.0	.	1.0	.	0.81	.	0.17	.	2.04	.	0.01	.	0.48	.	1421.7	.	.	.	70.6	.	.	.	1.0
2	20	4Aug97:08:00	0.64	.	3.0	.	2.0	.	0.81	.	0.18	.	2.04	.	0.02	.	0.54	.	1407.5	.	.	.	70.3	.	.	.	1.0
2	20	4Aug97:11:00	1	1.14	3.0	3.5	1.5	2.5	0.72	0.8	0.22	0.25	2.13	2.03	0	0.02	0.55	0.61	1359.2	1354.17	.	.	73.1	77.8	.	.	1.0
2	20	4Aug97:14:00	1	0.96	3.0	3.5	3.0	2.0	0.76	0.78	0.21	0.26	2.06	2.19	0.07	0.23	0.46	0.47	1400	1385.83	.	.	74.5	73.9	.	.	1.0
2	20	4Aug97:17:00	1.64	1.28	12.0	13.0	4.5	4.0	1.35	1.3	0.55	0.46	1.86	1.7	0.31	0.2	0.27	0.25	1157.5	1083.33	.	.	68.7	65.9	.	.	1.1
2	20	4Aug97:20:00	1.18	.	2.5	.	2.0	.	0.82	.	0.29	.	1.91	.	0.15	.	0.48	.	1350	.	.	.	81.2	.	.	.	1.0
2	20	4Aug97:23:00	0.91	.	3.0	.	2.0	.	0.73	.	0.26	.	2.2	.	0.12	.	0.47	.	1379.2	.	.	.	76	.	.	.	1.0
2	20	5Aug97:02:00	0.73	.	2.5	.	2.0	.	0.81	.	0.22	.	2.12	.	0.08	.	0.45	.	1380	.	.	.	78.6	.	.	.	1.0
2	20	5Aug97:05:00	0.64	.	3.5	.	2.5	.	0.89	.	0.23	.	2.62	.	0.1	.	0.38	.	1432.5	.	.	.	71.1	.	.	.	1.0
2	20	5Aug97:08:00	0.77	.	3.5	.	2.0	.	0.83	.	0.27	.	2.31	.	0.05	.	0.39	.	1429.2	.	.	.	68.2	.	.	.	1.0
2	20	5Aug97:11:00	1.14	.	4.5	.	2.5	.	0.89	.	0.24	.	2.47	.	0.01	.	0.28	.	1387.5	.	.	.	72.1	.	.	.	1.0
2	20	5Aug97:14:00	1.28	.	3.5	.	1.5	.	0.75	.	0.23	.	2.2	.	0	.	0.4	.	1420	.	.	.	66.1	.	.	.	1.0
2	20	5Aug97:17:00	1.14	.	3.0	.	1.5	.	0.82	.	0.19	.	2.09	.	0	.	0.39	.	1395	.	.	.	74.1	.	.	.	1.0
2	20	5Aug97:20:00	1.09	.	5.5	.	5.0	.	0.72	.	0.2	.	1.93	.	0	.	0.37	.	1377.5	.	.	.	67.9	.	.	.	1.0
2	20	5Aug97:23:00	1.05	1	2.0	2.5	1.0	2.0	0.85	0.83	0.18	0.2	2.03	2.1	0	0	0.35	0.36	1392.5	1375.83	.	.	66.6	66	.	.	1.0
2	20	6Aug97:02:00	0.68	0.82	2.5	4.5	2.5	1.5	0.8	0.81	0.24	0.23	2.11	2	0.03	0	0.32	0.35	1403.3	1386.67	.	.	65.1	68	.	.	1.0
2	20	6Aug97:05:00	1.73	1.91	10.0	13.0	2.0	3.0	1.5	1.48	0.51	0.54	2.05	2.12	0.01	0	0.22	0.25	1061.7	1022.5	.	.	62.6	62.6	.	.	1.6
2	20	6Aug97:08:00	0.91	.	3.0	.	2.0	.	1.04	.	0.26	.	2.28	.	0	.	0.38	.	1340	.	.	.	64.9	.	.	.	1.4
2	20	6Aug97:11:00	2.19	.	20.0	.	6.0	.	1.47	.	0.46	.	2.39	.	0.03	.	0.23	.	1128.5	.	.	.	68	.	.	.	1.3
2	20	6Aug97:14:00	2.28	.	24.0	.	4.8	.	0.87	.	0.27	.	1.5	.	0.05	.	0.3	.	1140.8	.	.	.	65.9	.	.	.	1.1
2	20	6Aug97:17:00	1.55	.	8.8	.	0.0	.	1.41	.	0.4	.	1.35	.	0.01	.	0.29	.	1152.5	.	.	.	61.8	.	.	.	1.8
2	20	6Aug97:20:00	1.73	2.19	11.0	15.3	0.0	3.3	1.31	1.3	0.37	0.38	1.6	1.9	0.07	0.04	0.25	0.27	1129.2	1064.17	.	.	58.7	65.4	.	.	3.2
2	20	6Aug97:23:00	1.28	.	14.0	.	2.0	.	1.14	.	0.34	.	1.68	.	0.01	.	0.27	.	1058.3	.	.	.	61.8	.	.	.	2.0
2	20	7Aug97:02:00	1.64	1.46	14.7	12.0	4.7	5.3	1.41	1.44	0.44	0.47	2.25	2.59	0	0.02	0.24	0.23	1120.8	1029.17	.	.	72.7	69.4	.	.	1.2
2	20	7Aug97:05:00	1.14	.	8.0	.	4.0	.	1.59	.	0.47	.	3.31	.	0.04	.	0.35	.	1060.8	.	.	.	63.8	.	.	.	2.5
2	20	7Aug97:08:00	1.28	1.05	13.3	10.0	6.0	3.3	1.42	1.53	0.47	0.49	2.71	2.89	0.02	0.03	0.23	0.27	1062.5	1058.33	.	.	67	64.1	.	.	1.3

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	20	7Aug97:11:00	1.18	.	4.7	.	2.7	.	0.92	.	0.18	.	1.82	.	0.02	.	0.32	.	1350	.	.	.	69.1	.	.	.	1.1
2	20	7Aug97:14:00	2.64	1.91	16.0	10.0	2.0	4.0	2.87	2.45	0.51	0.47	5.83	5.7	0.08	0.03	0.25	0.24	925	872.5	.	.	71.5	68.4	.	.	1.0
2	20	7Aug97:17:00	2	.	12.0	.	2.0	.	2.46	.	0.48	.	5.82	.	0.01	.	0.26	.	855	.	.	.	69.2	.	.	.	1.1
2	20	7Aug97:20:00	2.73	.	22.0	.	5.0	.	3.17	.	0.53	.	5.26	.	0	.	0.27	.	917.5	.	.	.	73.6	.	.	.	1.1
2	20	7Aug97:23:00	2.64	2.46	10.7	16.7	1.3	2.0	3.08	3.37	0.47	0.55	5.05	5.4	0	0	0.26	0.26	928.33	960.83	.	.	72.5	72	.	.	1.1
2	20	8Aug97:02:00	2.55	2.55	14.0	12.0	3.3	4.7	3.01	3.45	0.47	0.54	5.23	5.37	0	0	0.26	0.26	985.83	979.17	.	.	73.8	77.6	.	.	1.1
2	20	8Aug97:05:00	2	.	12.0	.	3.3	.	3.38	.	0.54	.	5.26	.	0.04	.	0.24	.	923.33	.	.	.	72.2	.	.	.	1.1
2	20	8Aug97:08:00	2.73	.	15.3	.	2.0	.	3.56	.	0.47	.	4.96	.	0.09	.	0.28	.	915.83	.	.	.	67.6	.	.	.	1.2
2	20	8Aug97:11:00	3.37	.	18.0	.	4.7	.	3.6	.	0.51	.	6.18	.	0.01	.	0.27	.	995	.	.	.	74.6	.	.	.	1.1
2	20	8Aug97:14:00	1.73	1.46	1.1	1.7	2.3	0.6	0.82	0.76	0.2	0.19	2.2	1.98	0.04	0	0.48	0.42	1495.8	1434.17	.	.	62.1	65.4	.	.	1.1
2	20	8Aug97:17:00	1.37	.	0.6	.	0.0	.	0.71	.	0.2	.	1.77	.	0	.	0.48	.	1484.2	.	.	.	69.3	.	.	.	1.1
2	20	8Aug97:20:00	1.37	.	0.5	.	0.0	.	0.69	.	0.2	.	1.53	.	0.02	.	0.49	.	1417.5	.	.	.	69.7	.	.	.	1.1
2	20	8Aug97:23:00	0.77	0.91	4.0	1.7	2.0	1.1	0.85	0.83	0.26	0.23	1.68	1.74	0.04	0.05	0.46	0.51	1357.5	1387.5	.	.	69	68	.	.	1.1
2	20	9Aug97:02:00	1	1.18	4.6	2.9	3.4	2.3	0.82	0.83	0.19	0.21	1.65	1.78	0.02	0.03	0.47	0.51	1400.8	1385	.	.	65.3	68.2	.	.	1.1
2	20	9Aug97:05:00	0.96	.	2.3	.	0.6	.	0.85	.	0.23	.	1.85	.	0.03	.	0.51	.	1435	.	.	.	64.1	.	.	.	1.1
2	20	9Aug97:08:00	1.82	.	8.6	.	4.0	.	1.03	.	0.4	.	2.33	.	0.08	.	0.19	.	1075	.	.	.	63	.	.	.	1.2
2	20	9Aug97:11:00	1.82	.	3.4	.	2.9	.	0.9	.	0.25	.	2.04	.	0.06	.	0.49	.	1402.5	.	.	.	67.6	.	.	.	1.1
2	20	9Aug97:14:00	1.18	1.46	4.7	2.0	1.3	0.7	0.84	0.93	0.26	0.34	1.83	2.18	0.04	0.07	0.53	0.51	1380.8	1476.67	.	.	65.2	64.3	.	.	1.1
2	20	9Aug97:17:00	1.28	1.73	4.0	3.4	0.7	2.3	0.96	0.93	0.28	0.32	1.83	1.87	0.05	0.06	0.54	0.52	1460	1353.33	.	.	63.8	68.1	.	.	1.1
2	20	9Aug97:20:00	1.23	.	2.9	.	2.3	.	0.97	.	0.24	.	1.86	.	0.06	.	0.44	.	1387.5	.	.	.	62.6	.	.	.	1.1
2	20	9Aug97:23:00	0.96	.	3.4	.	2.3	.	0.88	.	0.2	.	1.81	.	0.04	.	0.46	.	1527.5	.	.	.	66	.	.	.	1.1
2	20	10Aug97:02:00	0.87	.	5.1	.	4.0	.	0.86	.	0.25	.	1.84	.	0.05	.	0.46	.	1500.8	.	.	.	65.3	.	.	.	1.1
2	20	10Aug97:05:00	0.87	.	2.9	.	1.7	.	0.85	.	0.24	.	1.97	.	0.04	.	0.51	.	1448.3	.	.	.	66.1	.	.	.	1.1
2	20	10Aug97:08:00	0.18	.	3.5	.	1.5	.	0.89	.	0.25	.	2.16	.	0.1	.	0.55	.	1508.3	.	.	.	66.2	.	.	.	1.2
2	20	10Aug97:11:00	1.55	1.82	2.5	3.5	1.5	2.0	0.84	0.87	0.25	0.21	2.24	2.15	0.06	0.05	0.59	0.6	1424.2	1420	.	.	66.3	66.5	.	.	1.1
2	20	10Aug97:14:00	1.09	.	3.5	.	3.0	.	0.85	.	0.21	.	2.09	.	0.01	.	0.52	.	1483.3	.	.	.	64.6	.	.	.	1.1
2	20	10Aug97:17:00	1.73	1.73	8.6	10.3	4.6	4.0	0.8	0.92	0.21	0.33	1.95	1.98	0.02	0.02	0.51	0.55	1442.5	1447.5	.	.	67.5	66.6	.	.	1.1
2	20	10Aug97:20:00	1.09	.	7.0	.	4.0	.	0.9	.	0.23	.	1.79	.	0.03	.	0.5	.	1433.3	.	.	.	62.4	.	.	.	1.1
2	20	10Aug97:23:00	1.09	0.82	6.3	4.0	4.6	3.4	0.8	0.88	0.23	0.24	1.7	1.82	0	0	0.57	0.57	1380.8	1482.5	.	.	64.7	64.1	.	.	1.1
2	20	11Aug97:02:00	0.96	.	5.1	.	2.9	.	0.85	.	0.25	.	1.76	.	0.03	.	0.43	.	1368.3	.	.	.	70.2	.	.	.	1.1
2	20	11Aug97:05:00	0.82	.	6.3	.	3.4	.	0.82	.	0.25	.	1.9	.	0.03	.	0.56	.	1415	.	.	.	66	.	.	.	1.1
2	20	11Aug97:08:00	0.64	.	4.0	.	3.4	.	1.13	.	0.33	.	2.85	.	0.03	.	0.5	.	1356.7	.	.	.	65.6	.	.	.	1.1
2	20	11Aug97:11:00	1.46	1.64	5.7	2.9	3.4	1.7	0.75	0.82	0.21	0.17	1.91	1.91	0.02	0	0.52	0.5	1386.7	1351.67	.	.	62.1	62.7	.	.	1.1
2	20	11Aug97:14:00	1.18	.	5.3	.	2.0	.	0.81	.	0.2	.	2.09	.	0	.	0.49	.	1423.3	.	.	.	62.4	.	.	.	1.1
2	20	11Aug97:17:00	1.28	.	5.1	.	4.0	.	0.77	.	0.18	.	1.61	.	0.03	.	0.49	.	1445	.	.	.	67.5	.	.	.	1.1
2	20	11Aug97:20:00	1	.	6.3	.	4.0	.	0.92	.	0.28	.	1.68	.	0.18	.	0.51	.	1423.3	.	.	.	63.1	.	.	.	1.1
2	20	11Aug97:23:00	0.96	0.87	2.9	1.1	2.3	1.1	0.78	0.8	0.18	0.22	1.65	1.67	0.05	0.03	0.51	0.63	1432.5	1384.17	.	.	65.3	63.6	.	.	1.1
2	20	12Aug97:02:00	0.73	0.77	2.9	3.5	2.3	3.0	0.83	0.83	0.29	0.2	1.91	1.79	0.18	0.17	0.52	0.49	1419.2	1357.5	.	.	64.4	63	.	.	1.1
2	20	12Aug97:05:00	0.68	.	2.0	.	2.0	.	0.66	.	0.24	.	1.97	.	0.08	.	0.6	.	1406.7	.	.	.	61.1	.	.	.	1.1
2	20	12Aug97:08:00	0.83	0.87	1.5	3.0	0.0	1.0	0.63	0.71	0.19	0.18	1.6	1.69	0.15	0.13	0.57	0.56	1405.8	1380.83	.	.	60.5	62	.	.	1.1
2	20	12Aug97:11:00	1.05	.	2.0	.	1.0	.	0.65	.	0.18	.	1.72	.	0.11	.	0.62	.	1409.2	.	.	.	65.7	.	.	.	1.1
1	20	2Aug97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.6
1	20	2Aug97:17:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.6
1	20	2Aug97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.6
1	20	2Aug97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.7
1	20	3Aug97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.8
1	20	3Aug97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.8
1	20	3Aug97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.7
1	20	3Aug97:11:00	11.1	10.6	10.7	13.3	6.7	8.0	1.48	1.45	0.67	0.65	10.2	8.94	0.05	0.07	0.8	0.72	1538.3	1317.5	.	.	93.8	93.1	.	.	2.7
1	20	3Aug97:14:00	9.35	7.44	15.0	10.0	8.3	6.7	1.43	1.28	0.69	0.69	10.2	11.3	0.03	0.05	0.77	0.77	1355.8	1339.17	.	.	94.1	106	.	.	2.7
1	20	3Aug97:17:00	7.02	8.45	16.7	18.3	6.7	6.7	1.02	0.83	0.48	0.48	8.91	12.3	0.07	0.03	0.84	0.93	1493.3	1365	.	.	.	90.9	.	.	2.8

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	20	3Aug97:20:00	6.06	.	29.2	.	7.7	.	0.63	.	0.47	.	10	.	0.1	.	0.93	.	1600.8	.	.	.	101	.	.	.	3.3
1	20	3Aug97:23:00	5.58	.	16.9	.	6.2	.	0.56	.	0.37	.	8.97	.	0.04	.	0.84	.	1632.5	.	.	.	96	.	.	.	3.3
1	20	4Aug97:02:00	7.87	.	4.6	.	.	.	0.97	.	0.57	.	10	.	0.02	.	0.86	.	1540.8	.	.	.	101	.	.	.	3.3
1	20	4Aug97:05:00	8.72	.	7.7	.	4.6	.	0.87	.	0.51	.	9.1	.	0	.	0.69	.	1575	.	.	.	94.6	.	.	.	2.9
1	20	4Aug97:08:00	7.23	.	12.3	.	4.6	.	0.66	.	0.47	.	8.25	.	0.02	.	0.82	.	1426.7	.	.	.	91.5	.	.	.	2.8
1	20	4Aug97:11:00	6.8	9.14	15.4	9.2	6.2	4.6	0.86	0.76	0.5	0.53	6.52	7.53	0.01	0	0.86	0.73	1359.2	1524.17	.	.	100	93.4	.	.	2.7
1	20	4Aug97:14:00	9.99	10.6	1.5	16.9	1.5	4.6	1.12	1.29	0.47	0.49	6.44	6.78	0.02	0.04	0.7	0.8	1509.2	1333.33	.	.	94.2	89.6	.	.	2.6
1	20	4Aug97:17:00	11.1	9.14	12.3	9.2	6.2	4.6	1.37	1.49	0.55	0.62	6.87	7.01	0.05	0.04	1	0.74	1329.2	1504.17	.	.	96.2	93.9	.	.	2.7
1	20	4Aug97:20:00	11.3	.	7.7	.	4.6	.	1.59	.	0.59	.	9.99	.	0	.	0.85	.	1483.3	.	.	.	89	.	.	.	2.8
1	20	4Aug97:23:00	9.14	.	7.7	.	4.6	.	1.91	.	0.69	.	10.2	.	0.05	.	0.77	.	1520	.	.	.	93.1	.	.	.	2.8
1	20	5Aug97:02:00	8.5	.	3.1	.	1.5	.	2.13	.	0.75	.	10.3	.	0.03	.	0.73	.	1523.3	.	.	.	92.1	.	.	.	2.9
1	20	5Aug97:05:00	8.29	.	3.1	.	3.1	.	1.99	.	0.73	.	9.47	.	0.04	.	0.86	.	1609.2	.	.	.	96.8	.	.	.	2.8
1	20	5Aug97:08:00	5.95	.	6.7	.	4.0	.	1.42	.	0.49	.	6.49	.	0.06	.	0.71	.	1584.2	.	.	.	92.9	.	.	.	2.6
1	20	5Aug97:11:00	7.65	.	10.7	.	8.0	.	0.66	.	0.34	.	5.13	.	0.06	.	1.15	.	1597.5	.	.	.	92.5	.	.	.	2.6
1	20	5Aug97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.7
1	20	5Aug97:17:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.1
1	20	5Aug97:20:00	10.8	.	18.7	.	13.3	.	1.14	.	0.47	.	10.7	.	0.1	.	0.84	.	1419.2	.	.	.	96.6	.	.	.	4.1
1	20	5Aug97:23:00	9.99	8.13	18.7	16.9	13.3	12.3	0.71	0.89	0.36	0.39	14.1	13.6	0.11	0.06	0.83	0.82	1303.3	1398.33	.	.	104	106	.	.	3.9
1	20	6Aug97:02:00	8.08	9.14	15.4	15.4	9.2	7.7	1.11	1.51	0.45	0.6	15	9	0.04	0.1	0.79	0.82	1509.2	1502.5	.	.	101	113	.	.	3.8
1	20	6Aug97:05:00	8.29	7.02	15.4	13.9	6.2	9.2	1.95	2.07	0.54	0.63	14.9	13.7	0.04	0.07	0.77	0.77	1469.2	1383.33	.	.	97.9	98.6	.	.	3.7
1	20	6Aug97:08:00	7.65	.	15.4	.	10.8	.	2.04	.	0.65	.	13.7	.	0.06	.	1	.	1375.8	.	.	.	95.6	.	.	.	3.5
1	20	6Aug97:11:00	8.45	.	15.4	.	10.8	.	1.42	.	0.48	.	8.68	.	0.04	.	0.84	.	1375.8	.	.	.	92.9	.	.	.	3.1
1	20	6Aug97:14:00	9.99	.	13.9	.	7.7	.	1.92	.	0.53	.	8.9	.	0.05	.	1.06	.	1370.8	.	.	.	99.4	.	.	.	3.5
1	20	6Aug97:17:00	10.6	.	16.9	.	10.8	.	1.17	.	0.38	.	11.2	.	0.06	.	0.9	.	1300	.	.	.	98.1	.	.	.	4.5
1	20	6Aug97:20:00	6.8	5.53	20.0	14.3	9.2	10.0	1.1	0.26	0.43	0.52	11.7	12	0.05	0.14	0.78	0.77	1446.7	1290.83	.	.	96.1	101	.	.	4.7
1	20	6Aug97:23:00	8.5	.	9.3	.	5.3	.	0.69	.	0.64	.	7.48	.	0.05	.	0.79	.	1512.5	.	.	.	88.3	.	.	.	4.0
1	20	7Aug97:02:00	7.65	7.65	12.0	5.3	8.0	6.7	0.81	1.05	0.58	0.58	8.3	8.04	0.04	0.02	0.76	0.81	1470.8	1344.17	.	.	84.1	86.6	.	.	4.3
1	20	7Aug97:05:00	8.29	.	10.7	.	8.0	.	0.52	.	0.43	.	4.86	.	0.09	.	0.66	.	1471.7	.	.	.	78.6	.	.	.	3.1
1	20	7Aug97:08:00	7.65	8.72	14.7	6.7	5.3	2.7	0.6	0.57	0.36	0.35	4.69	5.28	0.03	0.07	0.72	0.72	1490	1322.5	.	.	85.1	80.6	.	.	3.0
1	20	7Aug97:11:00	9.78	.	13.3	.	5.3	.	0.87	.	0.37	.	5.39	.	0.04	.	0.67	.	1497.5	.	.	.	87.6	.	.	.	2.9
1	20	7Aug97:14:00	5.53	8.08	17.3	12.0	12.0	10.7	1.28	1.67	0.44	0.47	5.1	5.4	0.05	0.05	0.78	0.76	1320	1383.33	.	.	85.1	82.4	.	.	2.8
1	20	7Aug97:17:00	10.8	.	18.7	.	13.3	.	1.42	.	0.44	.	5.19	.	0.04	.	0.81	.	1575.8	.	.	.	88.9	.	.	.	2.9
1	20	7Aug97:20:00	7.65	.	14.7	.	12.0	.	1.1	.	0.4	.	3.21	.	0.03	.	0.76	.	1461.7	.	.	.	88.7	.	.	.	2.9
1	20	7Aug97:23:00	8.08	8.93	20.0	20.0	14.7	12.0	1.25	0.71	0.42	0.29	3.36	3.28	0.07	0.02	0.66	0.61	1607.5	1570	.	.	84	86.1	.	.	2.8
1	20	8Aug97:02:00	7.02	6.59	12.0	8.0	8.0	5.3	0.7	0.56	0.29	0.33	7.13	3.53	0.03	0	0.59	0.6	1590	1585	.	.	83	88.9	.	.	2.8
1	20	8Aug97:05:00	7.02	.	12.0	.	8.0	.	0.73	.	0.28	.	4.24	.	0	.	0.59	.	1424.2	.	.	.	74.1	.	.	.	2.7
1	20	8Aug97:08:00	7.65	.	10.7	.	5.3	.	0.51	.	0.29	.	3.67	.	0.01	.	0.6	.	1340	.	.	.	76.2	.	.	.	2.6
1	20	8Aug97:11:00	6.59	.	9.3	.	5.3	.	0.68	.	0.27	.	4.99	.	0.02	.	0.67	.	1483.3	.	.	.	84.4	.	.	.	2.6
1	20	8Aug97:14:00	2.55	8.08	10.7	9.3	9.3	6.7	0.82	0.66	0.31	0.31	4.55	4.65	0.06	0.06	0.7	.	1418.3	1392.5	.	.	82	81.1	.	.	2.6
1	20	8Aug97:17:00	8.93	.	8.0	.	5.3	.	0.67	.	0.29	.	3.82	.	0.06	.	0.6	.	1309.2	.	.	.	80.1	.	.	.	2.6
1	20	8Aug97:20:00	4.68	.	4.0	.	2.7	.	0.54	.	0.26	.	3.45	.	0.06	.	0.55	.	1415	.	.	.	84.9	.	.	.	2.6
1	20	8Aug97:23:00	6.8	7.23	9.3	8.0	6.7	10.7	0.51	0.51	0.28	0.29	3.85	3.59	0.03	0.02	0.56	.	1373.3	1357.5	.	.	97.3	77.4	.	.	2.7
1	20	9Aug97:02:00	0.85	0.43	4.0	9.3	5.3	8.0	0.57	0.49	0.3	0.28	3.71	8.85	0.02	0.01	0.54	.	1321.7	1395	.	.	83.1	80.4	.	.	2.7
1	20	9Aug97:05:00	1.91	.	10.7	.	4.0	.	0.48	.	0.3	.	4.33	.	0	.	0.36	.	1407.5	.	.	.	86.4	.	.	.	2.8
1	20	9Aug97:08:00	0	.	20.0	.	10.7	.	0.5	.	0.26	.	4.06	.	0	.	0.51	.	1415	.	.	.	86.9	.	.	.	2.7
1	20	9Aug97:11:00	1.06	.	8.0	.	9.3	.	0.42	.	0.25	.	4.11	.	0.03	.	0.5	.	1425.8	.	.	.	84.7	.	.	.	2.7
1	20	9Aug97:14:00	7.23	7.65	10.7	14.7	6.7	8.0	0.94	0.91	0.4	0.37	5.14	5.19	0.06	0.02	0.47	0.48	1396.7	1400	.	.	80.6	85.7	.	.	2.6
1	20	9Aug97:17:00	8.29	8.93	9.3	12.0	6.7	8.0	1.28	1.99	0.35	0.49	6.31	7.35	0.05	0.08	0.46	0.44	1377.5	1368.33	.	.	85.1	85.9	.	.	2.8
1	20	9Aug97:20:00	4.25	.	12.0	.	9.3	.	0.9	.	0.37	.	5.14	.	0.04	.	0.43	.	1371.7	.	.	.	85.4	.	.	.	2.7
1	20	9Aug97:23:00	4.04	.	9.3	.	6.7	.	0.59	.	0.33	.	3.79	.	0.18	.	0.41	.	1365	.	.	.	73.1	.	.	.	2.6
1	20	10Aug97:02:00	7.65	.	12.0	.	8.0	.	0.65	.	0.29	.	4.58	.	0.06	.	0.34	.	1332.5	.	.	.	78.6	.	.	.	2.5

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	20	10Aug97:05:00	7.44	.	6.7	.	4.0	.	0.51	.	0.27	.	5.08	.	0.06	.	0.44	.	1348.3	.	.	.	79.4	.	.	.	2.5
1	20	10Aug97:08:00	2.76	.	12.0	.	10.7	.	2.48	.	0.35	.	7.47	.	0.11	.	0.43	.	1342.5	.	.	.	82	.	.	.	2.5
1	20	10Aug97:11:00	9.29	10	12.0	17.3	10.7	10.7	1.06	0.83	0.26	0.31	6.55	6.47	0.02	0.06	0.54	0.48	1359.2	1344.17	.	.	83.1	83.2	.	.	2.6
1	20	10Aug97:14:00	8.08	.	11.8	.	7.1	.	1.14	.	0.43	.	7.29	.	0.03	.	0.5	.	1441.7	.	.	.	82.5	.	.	.	2.6
1	20	10Aug97:17:00	7.65	7.97	8.2	9.4	7.1	4.7	1.39	1.31	0.49	0.49	6.88	7.07	0.1	0.07	0.56	0.55	1578.3	1390	.	.	80.9	86.9	.	.	2.6
1	20	10Aug97:20:00	2.98	.	15.3	.	8.2	.	0.7	.	0.33	.	4.08	.	0.17	.	0.41	.	1400.8	.	.	.	85.3	.	.	.	2.6
1	20	10Aug97:23:00	8.29	5.1	15.3	14.1	11.8	8.2	0.52	0.63	0.2	0.2	3.72	3.75	0.04	0.03	0.39	0.41	1334.2	1280.83	.	.	90.2	82.7	.	.	2.6
1	20	11Aug97:02:00	5.53	.	14.1	.	11.8	.	0.6	.	0.23	.	3.71	.	0.03	.	0.4	.	1365	.	.	.	77.4	.	.	.	2.5
1	20	11Aug97:05:00	8.5	.	16.5	.	11.8	.	0.46	.	0.22	.	3.41	.	0.01	.	0.41	.	1766.7	.	.	.	77.2	.	.	.	2.4
1	20	11Aug97:08:00	7.44	.	9.4	.	8.2	.	0.58	.	0.23	.	9.01	.	0.09	.	0.43	.	1333.3	.	.	.	72.9	.	.	.	2.4
1	20	11Aug97:11:00	7.87	7.65	14.1	4.7	9.4	3.5	0.78	0.78	0.3	0.32	4.89	4.87	0.05	0.01	0.51	0.46	1331.7	1315	.	.	81.7	80.6	.	.	2.4
1	20	11Aug97:14:00	7.23	.	14.1	.	9.4	.	0.57	.	0.45	.	6.17	.	0	.	0.98	.	1673.3	.	.	.	79.1	.	.	.	2.4
1	20	11Aug97:17:00	6.38	.	5.9	.	4.7	.	0.88	.	0.37	.	4.83	.	0.02	.	0.48	.	1370.8	.	.	.	78.4	.	.	.	2.5
1	20	11Aug97:20:00	7.02	.	10.6	.	8.2	.	0.47	.	0.26	.	3.39	.	0.04	.	0.5	.	1465.8	.	.	.	75.8	.	.	.	2.5
1	20	11Aug97:23:00	6.59	6.8	12.9	4.7	9.4	4.7	0.38	0.86	0.26	0.23	3.13	3.03	0	0.11	0.49	0.5	1494.2	1315.83	.	.	76.5	76.4	.	.	2.5
1	20	12Aug97:02:00	5.74	6.16	14.1	8.2	3.5	7.1	0.65	0.54	0.23	0.23	3.15	3.08	0.04	0.03	0.53	0.48	1310.8	1305	.	.	82.6	68.2	.	.	2.5
1	20	12Aug97:05:00	6.59	.	11.8	.	4.7	.	0.51	.	0.3	.	3.08	.	0.04	.	0.49	.	1351.7	.	.	.	78.1	.	.	.	2.6
1	20	12Aug97:08:00	4.68	5.74	4.7	7.1	5.9	4.7	0.79	0.59	0.28	0.24	3.11	3.24	0.07	0.04	0.37	0.38	1401.7	1316.67	.	.	79.4	72.7	.	.	2.6
1	20	12Aug97:11:00	7.23	.	8.2	.	5.9	.	0.65	.	0.24	.	3.07	.	0	.	0.49	.	1364.2	.	.	.	75.2	.	.	.	2.6
3	20	2Aug97:14:00	3.61	4.72	25.0	22.4	8.0	8.2	3.65	3.72	0.66	0.65	6.12	4.91	0.08	0.08	0.4	0.41	975	978.33	.	.	62.9	61.2	.	.	2.6
3	20	2Aug97:17:00	3.83	2.04	23.5	25.9	10.6	8.2	3.17	3.02	0.69	0.71	4.63	4.46	0.04	0.03	0.38	0.31	955.83	893.33	.	.	60.9	61.5	.	.	4.7
3	20	2Aug97:20:00	2.3	3.95	23.5	22.4	7.1	4.7	3.41	3.32	0.73	0.69	4.27	4.32	0.03	0.03	0.36	0.38	1015.8	965	.	.	60.9	62.4	.	.	3.8
3	20	2Aug97:23:00	3.32	.	23.0	.	8.0	.	3.46	.	0.71	.	4.32	.	0.06	.	0.41	.	943.33	.	.	.	65.8	.	.	.	4.0
3	20	3Aug97:02:00	2.81	.	16.5	.	7.1	.	3.37	.	0.71	.	4.58	.	0.01	.	0.34	.	995	.	.	.	62.4	.	.	.	4.3
3	20	3Aug97:05:00	1.66	.	14.1	.	4.7	.	3.43	.	0.67	.	6.76	.	0.08	.	0.32	.	950	.	.	.	62.4	.	.	.	4.3
3	20	3Aug97:08:00	3.06	.	11.8	.	4.7	.	3.56	.	0.76	.	5.06	.	0.04	.	0.36	.	956.67	.	.	.	60.4	.	.	.	4.2
3	20	3Aug97:11:00	3.83	2.3	17.7	18.8	2.4	4.7	3.57	3.68	0.73	0.71	6.41	5.62	0.02	0.05	0.37	0.36	985	998.33	.	.	59.8	62.1	.	.	4.2
3	20	3Aug97:14:00	2.64	3.19	20.0	17.0	3.0	1.0	4.06	4.08	0.68	0.65	5.06	5.1	0.09	0.02	0.22	0.27	1012.5	956.67	.	.	59.4	60.6	.	.	3.9
3	20	3Aug97:17:00	3.57	4.08	23.0	26.0	2.0	3.0	3.32	3.27	0.72	0.76	4.97	4.65	0.03	0.03	0.28	0.3	967.5	970	.	.	60.1	58.1	.	.	4.4
3	20	3Aug97:20:00	2.55	.	23.0	.	7.0	.	3.13	.	0.87	.	5.05	.	0.01	.	0.21	.	955	.	.	.	58.3	.	.	.	4.6
3	20	3Aug97:23:00	2.42	.	20.0	.	4.0	.	3.45	.	0.72	.	4.65	.	0	.	0.26	.	1011.7	.	.	.	58.6	.	.	.	3.9
3	20	4Aug97:02:00	2.04	.	13.0	.	6.0	.	3.54	.	0.68	.	5.77	.	0	.	0.29	.	1032.5	.	.	.	65.7	.	.	.	2.9
3	20	4Aug97:05:00	1.91	.	17.0	.	6.0	.	3.92	.	0.64	.	5.39	.	0.07	.	0.4	.	1020.8	.	.	.	63.1	.	.	.	2.6
3	20	4Aug97:08:00	2.81	.	20.0	.	5.0	.	3.43	.	0.67	.	6.39	.	0	.	0.31	.	1041.7	.	.	.	63.7	.	.	.	2.2
3	20	4Aug97:11:00	3.83	1.34	27.0	28.0	4.0	5.0	3.48	3.78	0.62	0.92	6.18	6.24	0	0.08	0.29	0.34	1052.5	1046.67	.	.	67.2	70.1	.	.	1.9
3	20	4Aug97:14:00	3.88	4.08	21.0	20.0	8.0	6.0	3.88	3.37	0.56	0.52	3.98	3.89	0	0.05	0.21	0.22	972.5	922.5	.	.	66.7	58.9	.	.	2.0
3	20	4Aug97:17:00	3.44	2.23	18.0	21.0	6.0	5.0	5.21	4.29	0.66	0.56	5.87	4.85	0	0.07	0.22	0.27	959.17	935	.	.	63	66.1	.	.	3.3
3	20	4Aug97:20:00	3.32	.	21.0	.	8.0	.	4.12	.	0.74	.	4.86	.	0.07	.	0.26	.	954.17	.	.	.	63.4	.	.	.	3.1
3	20	4Aug97:23:00	2.68	.	10.0	.	8.0	.	2.12	.	0.62	.	6.9	.	0.01	.	0.25	.	967.5	.	.	.	61.9	.	.	.	2.0
3	20	5Aug97:02:00	3.19	.	19.0	.	9.0	.	2.91	.	0.55	.	4.16	.	0.02	.	0.22	.	952.5	.	.	.	59.9	.	.	.	1.9
3	20	5Aug97:05:00	2.81	.	14.0	.	8.0	.	2.31	.	0.57	.	5.19	.	0.03	.	0.22	.	925.83	.	.	.	62.2	.	.	.	3.3
3	20	5Aug97:08:00	2.3	.	11.0	.	5.0	.	1.97	.	0.74	.	7.98	.	0.09	.	0.27	.	861.67	.	.	.	64.7	.	.	.	5.4
3	20	5Aug97:11:00	3.44	.	20.0	.	8.0	.	2.59	.	0.86	.	8.9	.	0.12	.	0.23	.	873.33	.	.	.	60.2	.	.	.	4.3
3	20	5Aug97:14:00	3.32	.	17.0	.	7.0	.	2.64	.	0.61	.	4.99	.	0.06	.	0.22	.	917.5	.	.	.	59.6	.	.	.	5.1
3	20	5Aug97:17:00	2.81	.	29.0	.	9.0	.	2.78	.	0.59	.	6.08	.	0.06	.	0.2	.	913.33	.	.	.	61.1	.	.	.	5.3
3	20	5Aug97:20:00	2.17	.	13.0	.	7.0	.	2.93	.	0.68	.	5	.	0.13	.	0.28	.	837.5	.	.	.	56.1	.	.	.	6.8
3	20	5Aug97:23:00	1.34	1.34	16.0	18.0	5.0	5.0	2.47	2.47	0.69	0.7	6.11	6.14	0.02	0.03	0.32	0.27	812.5	785	.	.	56.1	57.1	.	.	10.6
3	20	6Aug97:02:00	1.21	1.79	18.0	15.0	5.0	3.0	3.09	3.18	0.65	0.64	5.41	5.47	0.02	0.02	0.2	0.2	879.17	872.5	.	.	59.6	58.8	.	.	8.1
3	20	6Aug97:05:00	1.59	1.4	15.0	10.0	0.0	0.0	4.18	2.57	0.93	0.65	9.04	5.35	0.02	0.04	0.24	0.25	838.33	833.33	.	.	57.7	57.6	.	.	8.6
3	20	6Aug97:08:00	1.53	.	20.0	.	0.0	.	3.1	.	0.72	.	6.91	.	0	.	0.25	.	770.83	.	.	.	55.6	.	.	.	10.7
3	20	6Aug97:11:00	1.79	.	21.0	.	5.0	.	2.72	.	0.68	.	7.5	.	0.02	.	0.25	.	752.5	.	.	.	51.3	.	.	.	11.0

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	20	6Aug97:14:00	1.91	.	15.3	.	4.7	.	3.29		0.72	.	7.06		0.02	.	0.22	.	820	.	.	.	49.1	.	.	.	11.5
3	20	6Aug97:17:00	1.28	.	17.3	.	5.3	.	2.75		0.67	.	6.66	.	0.03	.	0.3	.	796.67	.	.	.	54.2	.	.	.	12.9
3	20	6Aug97:20:00	1	1	16.0	14.0	2.7	2.0	2.79	2.79	0.69	0.64	6.13	6.36	0.01	0.1	0.24	0.27	810.83	797.5	.	.	52.9	52.4	.	.	13.2
3	20	6Aug97:23:00	0.59	.	9.3	.	0.7	.	2.82		0.66	.	6.45	.	0.11	.	0.25		805	.	.	.	53.1	.	.	.	13.0
3	20	7Aug97:02:00	0.91	0.68	9.3	8.0	1.3	3.3	2.95	3.01	0.68	0.63	7.17	7.11	0.06	0.04	0.19	0.24	799.17	807.5	.	.	51.5	54	.	.	11.2
3	20	7Aug97:05:00	1.37	.	13.3	.	4.7	.	2.81		0.65	.	7.51	.	0.02	.	0.25	.	845	.	.	.	58.4	.	.	.	12.3
3	20	7Aug97:08:00	1.14	1.28	8.7	10.0	3.3	2.7	3	3.1	0.62	0.62	7.31	7.31	0.02	0	0.24	0.23	834.17	828.33	.	.	53.5	53.4	.	.	10.6
3	20	7Aug97:11:00	2.1	.	8.7	.	1.3	.	3.39	.	0.62	.	6.87	.	0	.	0.25	.	895	.	.	.	56.6	.	.	.	8.6
3	20	7Aug97:14:00	1.64	1.28	4.0	1.3	1.3	2.7	0.67	0.98	0.24	0.19	1.67	1.51	0.01	0.01	0.35	0.34	1384.2	1406.67	.	.	.	65.4	.	.	6.4
3	20	7Aug97:17:00	1.05	.	3.3	.	2.0	.	0.99	.	0.21	.	1.86	.	0.03	.	0.31	.	1390	.	.	.	63.9	.	.	.	7.9
3	20	7Aug97:20:00	2.28	.	10.0	.	4.0	.	1.29		0.5	.	1.71	.	0.03	.	0.31	.	1205	.	.	.	57.8	.	.	.	5.7
3	20	7Aug97:23:00	1.09	0.82	.	3.3	.	2.0	0.88	0.87	0.21	0.18	1.47	1.66	0.01	0.03	0.34	0.4	1410	1391.67	.	.	58.2	62.9	.	.	4.3
3	20	8Aug97:02:00	0.87	0.77	2.0	2.0	0.0	.	0.83	0.82	0.22	0.21	1.69	1.82	0.03	0	0.45	0.36	1368.3	1457.5	.	.	68.6	67.9	.	.	3.5
3	20	8Aug97:05:00	0.82	.	1.3	.	0.7	.	1.51	.	0.25	.	1.77	.	0.02	.	0.37	.	1370.8	.	.	.	61.7	.	.	.	3.2
3	20	8Aug97:08:00	0.91	.	2.0	.	0.7	.	0.94		0.2	.	1.86	.	0.05	.	0.36	.	1400		.	.	63.7	.	.	.	3.2
3	20	8Aug97:11:00	1.46	.	7.3	.	3.3	.	1.07		0.26	.	1.96	.	0.07	.	0.38	.	1383.3		.	.	66.9		.	.	2.7
3	20	8Aug97:14:00	2.64	1.91	20.0	13.0	8.0	5.0	4.16	4.05	0.53	0.52	5.02	5.16	0.03	0.02	0.29	0.13	940	948.33	.	.	62.9	60.6	.	.	2.4
3	20	8Aug97:17:00	2.76	.	14.0	.	5.0	.	3.98	.	0.56	.	5.1	.	0.05	.	0.18	.	947.5	.	.	.	60.4	.	.	.	2.5
3	20	8Aug97:20:00	2.93	.	24.0	.	9.6	.	3.88		0.62		6.46	.	0.05	.	0.15	.	969.17	.	.	.	65.4	.	.	.	2.4
3	20	8Aug97:23:00	3.44	2.3	16.8	12.8	6.4	7.2	3.84	3.8	0.62	0.61	7.87	7.78	0.05	0.05	0.18	0.21	980	965.83	.	.	72.1	70.6	.	.	2.4
3	20	9Aug97:02:00	2.55	2.93	10.4	11.2	3.2	7.2	3.69	3.75	0.6	0.61	8.07	7.96	0.06	0.02	0.16	0.12	960.83	938.33	.	.	72.4	70.9	.	.	2.4
3	20	9Aug97:05:00	1.85	.	12.0	.	5.6	.	3.76		0.6	.	10.2	.	0.03	.	0.13	.	964.17	.	.	.	75.9	.	.	.	2.4
3	20	9Aug97:08:00	1.66	.	11.2	.	4.0	.	3.82		0.63	.	8.53	.	0.11	.	0.15	.	985	.	.	.	73.6		.	.	2.3
3	20	9Aug97:11:00	2.17	.	29.6		7.2	.	2.14		0.55	.	11.7	.	0.26		0.26		811.67	.	.	.	71.5	.	.	.	2.7
3	20	9Aug97:14:00	0.73	2.46	13.6	13.6	9.6	4.0	2.91	1.17	0.55	0.27	8.55	5.23	0.02	0.07	0.23	0.23	965.83	923.33	.	.	65.6	65.5	.	.	5.5
3	20	9Aug97:17:00	4.25	4.08	29.0	30.0	8.0	7.0	4.1	4.1	0.57	0.57	7.68	7.91	0.03	0.02	0.29	0.29	1011.7	975.83	.	.	72.9	72.6	.	.	2.6
3	20	9Aug97:20:00	2.55	.	9.0	.	3.0	.	4.08		0.61		7.95	.	0.01	.	0.29		1005.8		.	.	75.4	.	.	.	2.3
3	20	9Aug97:23:00	3.32		24.0	.	6.0	.	3.89	.	0.59	.	7.82		0	.	0.29	.	1025	.	.	.	74.5	.	.	.	2.3
3	20	10Aug97:02:00	2.55		10.4	.	4.8	.	4.14	.	0.63	.	8.09		0	.	0.3	.	992.5	.	.	.	77.4		.	.	2.2
3	20	10Aug97:05:00	2.3		7.2	.	3.2	.	3.98	.	0.62	.	8.17		0	.	0.29		1001.7	.	.	.	74.2		.	.	2.2
3	20	10Aug97:08:00	2		15.2		8.0		3.99		0.6	.	8.77		0		0.29		1015		.	.	70.9		.	.	2.1
3	20	10Aug97:11:00	1.4	1.53	14.4	14.4	7.2	5.6	3.72	3.84	0.61	0.59	8.72	8.66	0.03	0	0.34	0.31	997.5	986.67	.	.	71.1	76.3	.	.	2.0
3	20	10Aug97:14:00	2.3		13.6		4.0		3.91		0.63		7.77		0.02		0.3	.	1215.8		.	.	71.5		.	.	1.9
3	20	10Aug97:17:00	3.06	2.93	12.8	14.4	7.2	7.2	3.81	3.85	0.63	0.64	7.78	8.54	0.03	0	0.3	0.27	1060.8	1008.33	.	.	74.4	75.1	.	.	2.0
3	20	10Aug97:20:00	2.19		16.0	.	6.4	.	3.78	.	0.64	.	9.12	.	0.01	.	0.26	.	997.5	.	.	.	76.8	.	.	.	1.9
3	20	10Aug97:23:00	1.66	2.04	14.4	16.0	5.6	5.6	3.91	3.99	0.65	0.69	9.5	9.01	0.03	0	0.27	0.31	1049.2	1065	.	.	73.6	73.8	.	.	1.8
3	20	11Aug97:02:00	2.55		11.2	.	8.0		4.09		0.68		8.57		0.08		0.27	.	1140.8	.	.	.	71.7		.	.	1.8
3	20	11Aug97:05:00	2.3		8.0		0.8		4.06		0.67	.	9.26		0.01		0.27	.	1062.5	.	.	.	73.4		.	.	1.8
3	20	11Aug97:08:00	1.53		10.4	.	1.6	.	4.21		0.6	.	7.97	.	0	.	0.25	.	1020	.	.	.	69.9		.	.	1.7
3	20	11Aug97:11:00	3.7	3.19	21.6	16.8	2.4	0.8	3.79	3.79	0.43	0.46	5.62	5.41	0	0.01	0.25	0.26	979.17	935.83	.	.	65.7	67.3	.	.	1.8
3	20	11Aug97:14:00	2.3		8.8	.	0.0	.	3.84	.	0.61	.	9.03	.	0	.	0.27		1305	.	.	.	75	.	.	.	1.7
3	20	11Aug97:17:00	2.04		12.8		7.2		3.72		0.62	.	9.1	.	0	.	0.16	.	990	.	.	.	75.8		.	.	1.7
3	20	11Aug97:20:00	1.82		10.4	.	4.0		3.79		0.58	.	9.01	.	0	.	0.16	.	972.5	.	.	.	74.7		.	.	1.7
3	20	11Aug97:23:00	1.55	1.79	10.4	13.6	5.6	.	3.59	3.67	0.59	0.62	9.06	9.3	0	0	0.21	0.22	1018.3	1001.67	.	.	73	75.5	.	.	1.7
3	20	12Aug97:02:00	1.66	1.91	11.2	8.0	19.2		3.7	3.77	0.61	0.61	9.39	9.84	0	0	0.22	0.21	974.17	1001.67	.	.	78	73.6	.	.	1.6
3	20	12Aug97:05:00	0.57		15.2		9.6		3.73		0.64	.	10.2		0.11		0.23		1021.7	.	.	.	77.7		.	.	1.5
3	20	12Aug97:08:00	1.38	1.65	13.6	11.2	4.8	0.8	3.63	3.5	0.6	0.58	10.5	13.1	0	0.02	0.19	0.19	985	998.33	.	.	77.6	78.6	.	.	1.3
3	20	12Aug97:11:00	1.28		15.2	.	14.4		3.66		0.62		10		0		0.2	.	931.67	.	.	.	74.1	.	.	.	1.4
2	23	6Nov97:17:00	0.99		9.5	.	2.5		0.81		0.2	.	2.51		0.07	.	0.35	.	1006.7	.	.	.	46.1	.	.	.	1.0
2	23	6Nov97:20:00	0.59		5.5	.	4.0		1.15		0.21	.	2.4	.	0.05	.	0.37	.	1012.5	.	.	.	54.6	.	.	.	1.5
2	23	6Nov97:23:00	0.5	.	4.5	.	2.0		0.47		0.28	.	1.35	.	0.09	.	0.42		835	.	.	.	55.9		.	.	1.2

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	23	7Nov97:02:00	0.55	.	8.5	.	4.0	.	0.16	.	0.3		1.32	.	0.05	.	0.39	.	835.8		.	.	54.7	.	.	.	1.3
2	23	7Nov97:05:00	0.68	0.41	10.0	4.0	4.5	1.5	0.47	0.51	0.31	0.35	1.38	1.4	0.09	0.09	0.35	0.32	823.2	757.3		.	54.5	54.9	.	.	1.4
2	23	7Nov97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.2
2	23	7Nov97:11:00	1.55	1.64	3.5	6.0	2.5	2.0	1.29	1.25	0.21	0.27	3	3.22	0.04	0.03	0.39	0.38	995.8	1104.2	.	.	61.3	70.3	.	.	5.5
2	23	7Nov97:14:00	0.26	0.68	4.5	4.5	2.0	2.5	1.3	0.84	0.25	0.24	2.59	2.41	0.06	0.04	0.34	0.31	1010	905.8	.	.	61.5	57.2	.	.	2.5
2	23	7Nov97:17:00	0.98	0.34	6.0	6.0	3.0	2.5	1.11	1.13	0.25	0.21	2.84	3.27	0.02	0.02	0.36	0.35	1073.3	1070.8	.	.	56.4	58.5	.	.	1.8
2	23	7Nov97:20:00	0.72	.	4.0	.	3.5	.	0.64	.	0.27	.	1.9	.	0.03	.	0.28	.	907.5	.	.	.	61.6	.	.	.	1.4
2	23	7Nov97:23:00	0.29	.	5.5	.	2.5	.	0.67	.	0.26	.	1.48	.	0.06	.	0.38	.	874.2	.	.	.	53	.	.	.	2.7
2	23	8Nov97:02:00	0.38	.	6.5	.	3.5	.	0.69	.	0.37	.	1.39	.	0.06	.	0.33	.	809	.	.	.	50.2	.	.	.	3.0
2	23	8Nov97:05:00	0.6	.	8.0	.	3.0	.	0.73	.	0.43	.	1.47	.	0.06	.	0.29	.	772.7	.	.	.	47.5	.	.	.	6.1
2	23	8Nov97:08:00	0.77	.	5.5	.	3.0	.	0.91	.	0.38	.	2.28	.	0.08	.	0.33	.	761.8	.	.	.	49.5	.	.	.	13.1
2	23	8Nov97:11:00	0.51	0.53	9.0	7.0	2.0	2.5	0.68	0.52	0.41	0.33	1.5	1.32	0.07	0.05	0.31	0.26	768.8	794.8	.	.	46.9	47.1	.	.	9.8
2	23	8Nov97:14:00	1.01	1.04	4.5	7.0	2.0	4.0	1.08	1.03	0.31	0.35	2.31	2.43	0.05	0.06	0.35	0.5	971.7	985.8	.	.	50.1	55.6	.	.	5.3
2	23	8Nov97:17:00	0.63	.	9.3	.	4.1	.	0.75	.	0.32	.	2.51	.	0.08	.	0.29	.	838.3	.	.	.	53.6	.	.	.	4.7
2	23	8Nov97:20:00	0.47	.	8.9	.	3.9	.	0.52	.	0.35	.	1.26	.	0.08	.	0.28	.	802.9	.	.	.	30.4	.	.	.	4.5
2	23	8Nov97:23:00	0.46	0.55	8.0	6.0	3.5	3.5	0.7	0.59	0.29	0.27	1.55	1.89	0.08	0.05	0.29	0.33	796	790.4	.	.	51.8	50.1	.	.	13.7
2	23	9Nov97:02:00	0.47	.	8.5	.	3.5	.	0.47	.	0.26	.	1.44	.	0.05	.	0.22	.	765.3	.	.	.	48.8	.	.	.	11.1
2	23	9Nov97:05:00	0.5	.	7.5	.	4.5	.	0.43	.	0.33	.	1.58	.	0.04	.	0.21	.	814.4	.	.	.	50.7	.	.	.	6.8
2	23	9Nov97:08:00	0.66	0.75	8.5	5.6	3.0	2.0	0.28	0.31	0.21	0.19	1.24	1.14	0.08	0.06	0.31	0.27	832.1	836.7	.	.	49.5	51.6	.	.	13.8
2	23	9Nov97:11:00	0.61	0.63	5.0	3.5	1.5	2.5	0.57	0.64	0.25	0.27	2.31	2.64	0.05	0.08	0.23	0.25	851.7	855.8	.	.	48.8	48.6	.	.	13.8
2	23	9Nov97:14:00	0.3	.	3.5	.	1.0	.	0.43	.	0.22	.	1.77	.	0.1	.	0.33	.	810.8	.	.	.	46.7	.	.	.	10.1
2	23	9Nov97:17:00	0.48	.	8.0	.	3.5	.	1.1	.	0.18	.	1.97	.	0.07	.	0.37	.	837.5	.	.	.	51	.	.	.	6.0
2	23	9Nov97:20:00	0.67	.	7.0	.	4.0	.	0.38	.	0.26	.	1.1	.	0.07	.	0.37	.	845	.	.	.	50.8	.	.	.	5.2
2	23	9Nov97:23:00	0.94	.	4.0	.	2.5	.	0.46	.	0.23	.	1.16	.	0.08	.	0.34	.	826.1	.	.	.	52.3	.	.	.	12.9
2	23	10Nov97:02:00	0.74	0.43	7.0	7.0	3.5	3.5	0.52	0.45	0.26	0.24	1.5	1.4	0.12	0.1	0.27	0.25	840.8	818.3	.	.	47.5	48.9	.	.	12.0
2	23	10Nov97:05:00	0.61	0.41	9.0	10.0	2.5	4.0	0.27	0.21	0.27	0.24	1.29	1.16	0.08	0.08	0.27	0.26	819.8	817	.	.	51.3	47.5	.	.	6.8
2	23	10Nov97:08:00	14.2	.	8.0	.	3.0	.	0.24	.	0.15	.	1	.	0.09	.	0.28	.	816.8	.	.	.	49.1	.	.	.	9.5
2	23	10Nov97:11:00	0.58	.	1.1	.	1.1	.	0.22	.	0.16	.	0.96	.	0.05	.	0.29	.	864.2	.	.	.	47.4	.	.	.	14.1
2	23	10Nov97:14:00	0.64	0.54	5.0	3.5	2.0	1.0	0.25	0.33	0.13	0.13	0.5	0.53	0.05	0.05	0.38	0.23	878.3	865.8	.	.	51.4	48.2	.	.	13.7
2	23	10Nov97:17:00	0.57	0.64	4.0	3.5	1.0	0.5	0.29	0.27	0.16	0.17	1.91	1.64	0.03	0.03	0.31	0.23	870	881.7	.	.	50.1	50.7	.	.	13.6
2	23	10Nov97:20:00	0.64	0.55	8.0	8.5	2.5	2.0	0.29	0.35	0.18	0.17	1.04	0.78	0.06	0.06	0.42	0.29	859.2	885	.	.	53.6	52.1	.	.	10.7
2	23	10Nov97:23:00	0.8	0.82	7.3	7.5	3.3	3.5	0.32	0.27	0.18	0.17	1.08	1.07	0.06	0.02	0.32	0.27	832.2	826.9	.	.	100	102	.	.	13.2
2	23	11Nov97:02:00	0.59	.	4.5	.	1.5	.	0.29	.	0.17	.	1.34	.	0.02	.	0.36	.	844.2	.	.	.	51.8	.	.	.	13.3
2	23	11Nov97:05:00	0.53	.	3.5	.	2.5	.	0.55	.	0.21	.	1.65	.	0.04	.	0.28	.	824.4	.	.	.	66.1	.	.	.	12.4
2	23	11Nov97:08:00	0.41	.	9.5	.	3.0	.	0.61	.	0.19	.	2.46	.	0.09	.	0.36	.	872.5	.	.	.	48.6	.	.	.	8.8
2	23	11Nov97:11:00	0.82	.	7.0	.	2.0	.	0.18	.	0.15	.	0.86	.	0.02	.	0.34	.	1229.2	.	.	.	48.7	.	.	.	13.8
2	23	11Nov97:14:00	0.73	.	6.5	.	3.5	.	0.47	.	0.07	.	1.3	.	0	.	0.32	.	895	.	.	.	52.4	.	.	.	13.8
2	23	11Nov97:17:00	0.91	0.77	9.5	7.5	3.5	3.0	0.31	0.46	0.07	0.09	1.78	1.86	0	0.06	0.34	0.33	921.7	894.2	.	.	49.1	49.2	.	.	13.8
2	23	11Nov97:20:00	0.55	.	6.5	.	2.5	.	0.53	.	0.09	.	2.16	.	0.06	.	0.35	.	945.8	.	.	.	50.8	.	.	.	11.9
2	23	11Nov97:23:00	0.55	.	7.0	.	2.5	.	0.45	.	0.07	.	1.46	.	0.03	.	0.31	.	909.2	.	.	.	47.6	.	.	.	11.8
2	23	12Nov97:02:00	0.46	.	4.5	.	0.5	.	0.33	.	0.09	.	1.42	.	0.04	.	0.24	.	910	.	.	.	46.4	.	.	.	13.1
2	23	12Nov97:05:00	0.55	0.41	3.0	4.5	0.5	1.0	0.69	0.69	0.09	0.09	3.05	2.99	0.02	0	0.41	0.41	921.7	890.8	.	.	50.7	51.6	.	.	11.8
2	23	12Nov97:08:00	0.64	.	6.5	.	0.5	.	0.3	.	0.07	.	1.37	.	0	.	0.35	.	907.5	.	.	.	48	.	.	.	8.0
2	23	12Nov97:11:00	1	1.37	7.5	12.0	3.5	4.0	0.3	0.26	0.08	0.07	1.39	0.9	0	0	0.3	0.4	885	874.2	.	.	48.1	49.7	.	.	13.6
2	23	12Nov97:14:00	1.55	.	23.0	.	7.0	.	0.38	.	0.07	.	2.2	.	0	.	0.26	.	885	.	.	.	48	.	.	.	13.8
2	23	12Nov97:17:00	1.46	1.82	22.5	24.0	6.5	7.5	0.29	0.31	0.08	0.08	1.09	1.71	0	0	0.29	0.29	865.8	882.5	.	.	47.6	51.5	.	.	13.9
2	23	12Nov97:20:00	0.55	0.59	6.5	7.0	2.0	2.5	0.46	0.49	0.07	0.08	1.87	1.83	0	0.01	0.29	0.27	964.2	902.5	.	.	61.8	52.8	.	.	13.6
2	23	12Nov97:23:00	0.68	.	11.0	.	4.0	.	0.26	.	0.08	.	1.09	.	0	.	0.4	.	888.3	.	.	.	48.2	.	.	.	13.9
2	23	13Nov97:02:00	0.82	0.91	12.5	11.0	5.0	2.5	0.29	0.25	0.09	0.09	1.13	1.25	0	0	0.33	0.25	865.8	858.3	.	.	50.7	51	.	.	13.8
2	23	13Nov97:05:00	0.82	.	7.5	.	2.5	.	0.11	.	0.08	.	1.29	.	0	.	0.24	.	860	.	.	.	45.9	.	.	.	13.8
2	23	13Nov97:08:00	0.91	.	11.5	.	2.0	.	0.12	.	0.09	.	2.36	.	0	.	0.35	.	855.8	.	.	.	46	.	.	.	13.7

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	23	13Nov97:11:00	0.73	.	4.5	.	1.5	.	0.29	.	0.09	.	1.07	.	0	.	0.23	.	849.2	.	.	.	48.3	.	.	.	14.0
2	23	13Nov97:14:00	0.4	.	7.5	.	3.0	.	0.11	.	0.11	.	1.32	.	0.01	.	0.32	.	820.2	.	.	.	44.9	.	.	.	14.8
2	23	13Nov97:17:00	0.67	0.68	8.5	12.0	2.5	4.5	0.2	0.2	0.1	0.09	1.48	1.15	0	0	0.22	0.21	796.7	801.3	.	.	43.4	45.6	.	.	15.1
2	23	13Nov97:20:00	0.55	.	6.5	.	2.5	.	1.52	.	0.27	.	3.42	.	0.35	.	0.27	.	814.2	.	.	.	44.6	.	.	.	14.7
2	23	13Nov97:23:00	1.07	.	13.5	.	5.5	.	2.04	.	0.25	.	4.74	.	0.45	.	0.24	.	818.3	.	.	.	51.5	.	.	.	14.5
2	23	14Nov97:02:00	0.66	.	7.5	.	3.0	.	0.55	.	0.18	.	2.3	.	0.08	.	0.26	.	845	.	.	.	48.9	.	.	.	15.0
2	23	14Nov97:05:00	0.55	.	8.5	.	3.0	.	0.16	.	0.07	.	2.23	.	0	.	0.23	.	831	.	.	.	45.6	.	.	.	14.8
2	23	14Nov97:08:00	0.5	1.04	13.0	13.0	4.0	3.5	0.09	0.25	0.05	0.07	0.97	1.05	0	0	0.28	0.26	857.5	824.8	.	.	42.7	51.3	.	.	14.2
2	23	14Nov97:11:00	0.63	.	5.5	.	2.5	.	0.32	.	0.11	.	1.25	.	0.03	.	0.28	.	886.7	.	.	.	44.6	.	.	.	14.0
2	23	14Nov97:14:00	0.64	0.68	4.5	5.0	1.5	2.0	0.32	0.32	0.06	0.07	1.52	0.89	0	0	0.26	0.23	894.2	889.2	.	.	44.4	43.3	.	.	13.7
2	23	14Nov97:17:00	0.65	0.67	7.5	12.5	5.0	2.5	0.39	0.3	0.08	0.07	1.33	1.15	0.03	0.03	0.23	0.24	867.5	819.7	.	.	43	45	.	.	13.8
2	23	14Nov97:20:00	0.56	.	7.0	.	3.0	.	0.52	.	0.08	.	1.36	.	0.02	.	0.21	.	817.2	.	.	.	45	.	.	.	13.6
2	23	14Nov97:23:00	0.44	.	8.0	.	3.5	.	0.73	.	0.12	.	2.04	.	0.02	.	0.22	.	805.8	.	.	.	44.1	.	.	.	14.1
2	23	15Nov97:02:00	0.59	.	8.0	.	3.0	.	0.75	.	0.15	.	2	.	0.03	.	0.2	.	804.4	.	.	.	47.3	.	.	.	15.6
2	23	15Nov97:05:00	0.71	0.46	6.5	8.0	2.5	2.0	0.82	0.64	0.14	0.15	1.84	2.18	0.01	0	0.25	0.25	811.8	777.3	.	.	42.5	41.5	.	.	16.2
2	23	15Nov97:08:00	0.59	0.77	5.5	4.5	1.5	2.5	0.79	0.87	0.08	0.08	1.99	2.2	0.01	0.06	0.27	0.34	860	851.7	.	.	44.5	47.5	.	.	14.7
2	23	15Nov97:11:00	0.81	.	4.5	.	3.5	.	0.91	.	0.1	.	2.17	.	0.06	.	0.28	.	930.8	.	.	.	44.2	.	.	.	13.7
2	23	15Nov97:14:00	0.9	.	7.0	.	4.5	.	0.92	.	0.07	.	1.8	.	0.05	.	0.33	.	945.8	.	.	.	44.9	.	.	.	12.9
2	23	15Nov97:17:00	0.93	.	2.5	.	2.5	.	0.89	.	0.08	.	1.82	.	0.03	.	0.33	.	995.8	.	.	.	45.7	.	.	.	13.3
2	23	15Nov97:20:00	0.97	.	6.0	.	3.5	.	0.87	.	0.08	.	2.12	.	0.01	.	0.39	.	998.3	.	.	.	47.5	.	.	.	13.1
2	23	15Nov97:23:00	1.09	.	5.0	.	2.5	.	0.21	.	0.09	.	2.23	.	0.04	.	0.34	.	1045.8	.	.	.	47.4	.	.	.	12.2
2	23	16Nov97:02:00	0.85	0.89	3.0	2.5	1.5	2.5	0.5	0.6	0.07	0.08	2.4	2.41	0	0	0.33	0.4	1060.8	1039.2	.	.	50.4	52	.	.	11.4
2	23	16Nov97:05:00	0.8	.	4.0	.	3.5	.	0.79	.	0.08	.	2.71	.	0	.	0.4	.	1058.3	.	.	.	51.3	.	.	.	10.7
2	23	16Nov97:08:00	0.69	1.26	11.5	6.5	2.5	2.5	0.86	0.77	0.08	0.09	3.12	3.3	0	0	0.36	0.47	1085	1097.5	.	.	51.7	53.5	.	.	10.0
2	23	16Nov97:11:00	1.11	.	13.0	.	5.0	.	0.7	.	0.08	.	3.03	.	0	.	0.37	.	1068.3	.	.	.	51.8	.	.	.	9.4
2	23	16Nov97:14:00	1.6	1.12	9.5	2.0	3.5	2.0	0.71	0.62	0.1	0.1	3.18	3.22	0	0.04	0.39	0.43	1067.5	1102.5	.	.	53.3	52.8	.	.	8.8
1	23	6Nov97:17:00	6.07	.	36.0	.	6.7	.	0.01	.	0.09	.	0.91	.	0.08	.	0.55	.	1357.5	.	.	.	71.7	.	.	.	7.3
1	23	6Nov97:20:00	4.96	.	15.7	.	10.0	.	0.06	.	0.06	.	0.97	.	0.06	.	0.52	.	1295.8	.	.	.	84.4	.	.	.	7.0
1	23	6Nov97:23:00	6.49	.	6.7	.	10.0	.	0.06	.	0.09	.	0.95	.	0.05	.	0.54	.	1290.8	.	.	.	87.6	.	.	.	6.7
1	23	7Nov97:02:00	5.17	.	35.0	.	10.0	.	0.13	.	0.1	.	0.85	.	0.04	.	0.56	.	1420.8	.	.	.	77.7	.	.	.	6.5
1	23	7Nov97:05:00	6.18	6.18	1.7	10.0	1.7	6.7	0.15	0.11	0.1	0.11	0.38	0.89	0	0.02	0.58	0.54	1370	1285.8	.	.	80.7	85.3	.	.	6.5
1	23	7Nov97:08:00	7.29	.	56.7	.	10.0	.	0.25	.	0.1	.	1.69	.	0.02	.	0.62	.	1330.8	.	.	.	87.7	.	.	.	7.5
1	23	7Nov97:11:00	8.53	6.78	10.0	26.7	5.0	18.3	0.13	0.22	0.08	0.1	0.8	0.89	0.02	0	0.49	0.42	1321.7	1331.7	.	.	86.5	94.3	.	.	10.7
1	23	7Nov97:14:00	4.71	5.01	11.7	10.0	11.7	10.0	0.17	0.15	0.13	0.11	0.79	0.29	0.07	0.02	0.64	0.58	1390	1235.8	.	.	90.5	88.9	.	.	12.1
1	23	7Nov97:17:00	4.42	3.4	16.7	50.0	11.7	11.7	0.14	0.22	0.09	0.1	0.6	0.69	0.05	0.04	0.54	0.6	1263.3	1220	.	.	89.3	83.9	.	.	12.1
1	23	7Nov97:20:00	3.44	.	11.7	.	5.0	.	0.33	.	0.13	.	1.38	.	0.02	.	0.57	.	1264.2	.	.	.	88.8	.	.	.	12.1
1	23	7Nov97:23:00	7.09	.	21.7	.	11.7	.	0.46	.	0.08	.	0.55	.	0.07	.	0.7	.	1397.5	.	.	.	87.8	.	.	.	9.5
1	23	8Nov97:02:00	5.95	.	16.7	.	1.7	.	0.41	.	0.08	.	0.51	.	0.07	.	0.55	.	1216.7	.	.	.	85.9	.	.	.	8.3
1	23	8Nov97:05:00	4.93	.	10.0	.	10.0	.	0.46	.	0.12	.	0.45	.	0.05	.	0.6	.	1237.5	.	.	.	90.9	.	.	.	8.2
1	23	8Nov97:08:00	6.8	.	15.0	.	10.0	.	0.39	.	0.08	.	1.26	.	0.07	.	0.82	.	1361.7	.	.	.	90.3	.	.	.	8.9
1	23	8Nov97:11:00	4.42	4.08	11.7	28.3	6.7	13.3	0.43	0.44	0.1	0.13	1.09	1.23	0.06	0.1	0.62	0.64	1375.8	1189.2	.	.	87.1	75.7	.	.	10.7
1	23	8Nov97:14:00	7.62	2.73	8.3	16.7	11.7	10.0	0.73	0.56	0.12	0.12	0.79	0.82	0.08	0.03	0.52	0.46	1354.2	1308.3	.	.	77.4	78.1	.	.	12.0
1	23	8Nov97:17:00	1.53	.	21.7	.	8.3	.	0.47	.	0.06	.	0.78	.	0.06	.	0.79	.	1129.2	.	.	.	77.4	.	.	.	13.3
1	23	8Nov97:20:00	5.1	.	25.5	.	12.7	.	0.63	.	0.12	.	1.48	.	0.09	.	0.56	.	1251.7	.	.	.	78.3	.	.	.	13.4
1	23	8Nov97:23:00	2.55	2.37	3.6	25.5	5.5	10.9	0.86	0.76	0.19	0.13	3.21	3	0.05	0.07	0.59	0.65	1227.5	1280	.	.	65.7	77.3	.	.	14.0
1	23	9Nov97:02:00	5.47	.	5.5	.	5.5	.	0.4	.	0.07	.	0.86	.	0.02	.	0.59	.	1305	.	.	.	83.1	.	.	.	10.0
1	23	9Nov97:05:00	6.2	.	27.3	.	5.5	.	0.72	.	0.11	.	2.02	.	0.08	.	0.73	.	1148.3	.	.	.	75.7	.	.	.	10.1
1	23	9Nov97:08:00	7.31	5.44	10.0	25.0	8.3	10.0	0.57	0.89	0.13	0.2	1.85	2.42	0.03	0.04	0.31	0.33	1260.8	1141.7	.	.	75.5	77.9	.	.	13.5
1	23	9Nov97:11:00	7.29	5.28	13.3	5.0	11.7	8.3	1	1.02	0.12	0.13	0.98	1.01	0.08	0.05	0.33	0.26	1150.8	1142.5	.	.	72.1	75	.	.	14.1
1	23	9Nov97:14:00	7.14	.	41.7	.	11.7	.	0.9	.	0.13	.	0.56	.	0.02	.	0.46	.	1258.3	.	.	.	77.3	.	.	.	15.0
1	23	9Nov97:17:00	6.74	.	13.3	.	16.7	.	0.78	.	0.08	.	0.57	.	0.01	.	0.39	.	1284.2	.	.	.	97.1	.	.	.	16.3

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	23	9Nov97:20:00	6.01	.	23.3	.	13.3	.	0.86	.	0.09	.	0.73	.	0.05	.	0.37	.	1180	.	.	.	80.2	.	.	.	16.5
1	23	9Nov97:23:00	4.56	.	16.7	.	11.7	.	0.92	.	0.12	.	1.33	.	0	.	0.34	.	1284.2	.	.	.	79.3	.	.	.	16.4
1	23	10Nov97:02:00	5.1	5.47	11.7	13.3	10.0	10.0	1.04	1.3	0.12	0.17	1.68	1.69	0.06	0.03	0.34	0.37	1277.5	1134.2	.	.	.	.	.	.	16.1
1	23	10Nov97:05:00	5.83	5.1	26.7	25.0	10.0	11.7	1.22	1.08	0.1	0.09	0.92	0.76	0.06	0.09	0.32	0.34	1193.3	1130.8	.	.	.	.	.	.	16.3
1	23	10Nov97:08:00	6.74	.	8.3	.	6.7	.	1.09	.	0.1	.	1.25	.	0.06	.	0.46	.	1151.7	.	.	.	.	.	.	.	16.4
1	23	10Nov97:11:00	8.2	.	31.7	.	11.7	.	1.28	.	0.17	.	0.64	.	0.09	.	0.47	.	1325	.	.	.	.	.	.	.	16.4
1	23	10Nov97:14:00	4.74	7.65	28.3	23.3	10.0	10.0	1	0.96	0.09	0.08	0.35	0.62	0.01	0	0.38	0.42	1261.7	1135.8	.	.	.	.	.	.	16.6
1	23	10Nov97:17:00	5.65	5.47	18.3	13.3	10.0	6.7	1.05	1.18	0.11	0.12	0.39	0.44	0.01	0.01	0.38	0.37	1281.7	1210.8	.	.	.	.	.	.	17.0
1	23	10Nov97:20:00	3.1	4.37	20.0	10.0	6.7	5.0	1.37	0.94	0.14	0.09	0.69	0.64	0.09	0.06	0.37	0.4	1298.3	1225	.	.	.	.	.	.	17.4
1	23	10Nov97:23:00	3.64	5.47	21.7	3.3	8.3	5.0	0.96	0.97	0.14	0.15	0.75	0.6	0.08	0.04	0.37	0.35	1245.8	1113.3	.	.	.	.	.	.	17.6
1	23	11Nov97:02:00	4.92	.	25.0	.	3.3	.	0.93	.	0.15	.	1.79	.	0.02	.	0.32	.	1239.2	.	.	.	.	.	.	.	16.8
1	23	11Nov97:05:00	5.1	.	18.3	.	6.7	.	0.64	.	0.11	.	0.84	.	0	.	0.32	.	1219.2	.	.	.	.	.	.	.	17.6
1	23	11Nov97:08:00	4.37	.	10.0	.	5.0	.	0.72	.	0.14	.	1.7	.	0	.	0.31	.	1225	.	.	.	.	.	.	.	17.8
1	23	11Nov97:11:00	5.47	.	1.7	.	11.7	.	0.49	.	0.13	.	1.14	.	0	.	0.34	.	1116.7	.	.	.	.	.	.	.	17.8
1	23	11Nov97:14:00	5.65	.	124.0	.	30.0	.	0.7	.	0.06	.	0.71	.	0.02	.	0.45	.	1176.7	.	.	.	.	.	.	.	17.9
1	23	11Nov97:17:00	4.74	4.37	10.0	12.0	7.1	8.0	0.92	0.88	0.08	0.09	0.5	0.83	0.01	0	0.41	0.84	1338.3	1317.5	.	.	.	.	.	.	18.2
1	23	11Nov97:20:00	6.56	.	24.0	.	8.0	.	0.84	.	0.13	.	2.47	.	0.04	.	0.52	.	1305.8	.	.	.	.	.	.	.	18.3
1	23	11Nov97:23:00	2.37	.	18.0	.	8.0	.	0.61	.	0.09	.	2.07	.	0	.	0.51	.	1252.5	.	.	.	.	.	.	.	17.9
1	23	12Nov97:02:00	3.83	.	6.0	.	6.0	.	0.85	.	0.17	.	2.95	.	0.01	.	0.51	.	1313.3	.	.	.	.	.	.	.	18.2
1	23	12Nov97:05:00	4.01	5.83	118.0	14.0	26.0	6.0	0.45	0.39	0.09	0.07	1.16	1.14	0.04	0.03	0.61	0.55	1115	1138.3	.	.	.	.	.	.	17.9
1	23	12Nov97:08:00	6.74	.	8.0	.	8.0	.	0.59	.	0.08	.	1.75	.	0.04	.	0.75	.	1268.3	.	.	.	.	.	.	.	19.2
1	23	12Nov97:11:00	5.47	6.74	34.0	138.0	4.0	20.0	0.55	0.55	0.06	0.05	0.5	0.42	0.08	0.01	0.48	0.49	1288.3	1184.2	.	.	.	.	.	.	19.3
1	23	12Nov97:14:00	5.47	.	8.3	.	10.0	.	0.85	.	0.09	.	0.43	.	0.05	.	0.45	.	1269.2	.	.	.	.	.	.	.	20.6
1	23	12Nov97:17:00	5.28	5.83	35.0	33.3	15.0	11.7	0.91	0.94	0.05	0.05	0.34	0.48	0.04	0.03	0.43	0.56	1114.2	1265	.	.	.	.	.	.	21.3
1	23	12Nov97:20:00	6.01	5.1	31.7	30.0	10.0	10.0	0.98	0.91	0.07	0.05	0.42	0.43	0.01	0.03	0.45	0.44	1294.2	1237.5	.	.	.	.	.	.	21.1
1	23	12Nov97:23:00	4.92	.	26.7	.	5.0	.	0.73	.	0.03	.	0.33	.	0.03	.	0.47	.	1281.7	.	.	.	.	.	.	.	21.0
1	23	13Nov97:02:00	3.1	5.28	15.0	8.3	6.7	10.0	0.66	1.05	0.06	0.05	0.43	0.38	0.01	0.02	0.55	0.52	1255.8	1280.8	.	.	.	.	.	.	21.0
1	23	13Nov97:05:00	5.65	.	13.3	.	6.7	.	0.64	.	0.03	.	0.33	.	0	.	.	.	1285.8	.	.	.	.	.	.	.	20.7
1	23	13Nov97:08:00	4.74	.	35.0	.	5.0	.	0.53	.	0.04	.	0.58	.	0.02	.	0.42	.	1191.7	.	.	.	.	.	.	.	20.8
1	23	13Nov97:11:00	4.56	.	30.0	.	8.3	.	0.32	.	0.09	.	0.32	.	0	.	0.46	.	1259.2	.	.	.	.	.	.	.	21.9
1	23	13Nov97:14:00	4.01	.	10.0	.	5.0	.	0.55	.	0.04	.	0.62	.	0.03	.	0.47	.	1158.3	.	.	.	.	.	.	.	22.7
1	23	13Nov97:17:00	4.74	4.74	18.3	18.3	3.3	8.3	0.29	0.26	0.06	0.17	1.08	1.22	0.03	0	0.45	0.8	1192.5	1282.5	.	.	.	.	.	.	23.0
1	23	13Nov97:20:00	4.37	.	33.3	.	6.7	.	0.33	.	0.07	.	0.63	.	0.02	.	0.41	.	1192.5	.	.	.	.	.	.	.	23.2
1	23	13Nov97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.2
1	23	14Nov97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.1
1	23	14Nov97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.7
1	23	14Nov97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23.8
1	23	14Nov97:11:00	4.01	.	30.0	.	13.3	.	0.21	.	0.08	.	0.68	.	0.03	.	0.42	.	1262.5	.	.	.	.	.	.	.	23.8
1	23	14Nov97:14:00	4.01	3.28	8.3	45.0	8.3	10.0	0.32	0.44	0.06	0.08	0.74	0.83	0.03	0	0.39	0.43	1325.8	1255.8	.	.	.	.	.	.	23.9
1	23	14Nov97:17:00	3.1	3.28	20.0	28.3	5.0	10.0	0.73	0.81	0.13	0.21	1.78	1.86	0.04	0.02	0.44	0.43	1265	1304.2	.	.	.	.	.	.	23.8
1	23	14Nov97:20:00	3.46	.	21.7	.	6.7	.	0.53	.	0.15	.	1.38	.	0	.	0.59	.	1254.2	.	.	.	.	.	.	.	23.5
1	23	14Nov97:23:00	2	.	6.7	.	6.7	.	0.76	.	0.15	.	2	.	0.06	.	0.36	.	1255.8	.	.	.	.	.	.	.	23.8
1	23	15Nov97:02:00	3.83	.	25.0	.	10.0	.	0.9	.	0.07	.	1	.	0	.	0.43	.	1399.2	.	.	.	.	.	.	.	19.0
1	23	15Nov97:05:00	2.37	4.37	18.3	5.0	5.0	5.0	0.78	0.69	0.05	0.04	0.57	0.63	0.01	0.01	0.41	0.44	1400.8	1546.7	.	.	.	.	.	.	13.3
1	23	15Nov97:08:00	4.19	4.37	11.7	21.7	5.0	10.0	0.92	0.79	0	0.02	0.59	0.72	0	0.03	0.39	0.42	1495	1286.7	.	.	.	.	.	.	13.0
1	23	15Nov97:11:00	5.36	.	3.3	.	13.3	.	1.15	.	0.23	.	1.48	.	.	.	0.43	.	1337.5	.	.	.	.	.	.	.	12.8
1	23	15Nov97:14:00	4.88	.	15.0	.	8.3	.	0.71	.	0.16	.	2.57	.	0.05	.	0.42	.	1365	.	.	.	.	.	.	.	12.8
1	23	15Nov97:17:00	4.12	.	11.7	.	10.0	.	0.58	.	0.07	.	0.39	.	0	.	0.44	.	1221.7	.	.	.	.	.	.	.	13.0
1	23	15Nov97:20:00	2.71	.	23.3	.	11.7	.	0.51	.	0.07	.	0.54	.	0.03	.	0.56	.	1425	.	.	.	.	.	.	.	14.2
1	23	15Nov97:23:00	4.72	.	10.0	.	10.0	.	0.66	.	0.02	.	0.3	.	0.05	.	0.64	.	1430.8	.	.	.	.	.	.	.	13.9

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
1	23	16Nov97:02:00	4.74	4.76	8.3	31.7	8.3	8.3	0.77	0.54	0.01	0.12	0.28	0.29	0.04	0.03	0.46	0.46	1414.2	1227.5	.	.	.	.	.	.	13.5
1	23	16Nov97:05:00	4.35	.	6.7	.	6.7	.	0.96	.	0.02	.	0.37	.	0.02	.	0.52	.	1278.3	.	.	.	.	.	.	.	13.5
1	23	16Nov97:08:00	4.88	4.03	11.7	15.0	8.3	11.7	0.14	0.68	0.15	0.06	.	0.39	0.04	0.02	0.5	0.6	1269.2	1258.3	.	.	77.9	81.8	.	.	12.9
1	23	16Nov97:11:00	2.26	.	16.7	.	6.7	.	0.75	.	0.05	.	0.45	.	0.04	.	0.48	.	1350	.	.	.	76.5	.	.	.	12.6
1	23	16Nov97:14:00	3.32	4.59	3.3	10.0	8.3	10.0	0.82	0.77	0.01	0	0.68	1.2	0	0.03	0.41	0.42	1257.5	1310	.	.	82.9	77.3	.	.	12.4
3	23	6Nov97:17:00	0.91	.	7.4	.	1.1	.	0.74	.	0.15	.	2.63	.	0.03	.	0.19	.	645.8	.	.	.	48	.	.	.	7.5
3	23	6Nov97:20:00	0.51	.	9.7	.	4.0	.	0.62	.	0.16	.	2.25	.	0.04	.	0.33	.	649.3	.	.	.	47.9	.	.	.	13.7
3	23	6Nov97:23:00	1.02	.	12.0	.	4.6	.	0.67	.	0.11	.	2.01	.	0.02	.	0.2	.	662.3	.	.	.	42.9	.	.	.	9.0
3	23	7Nov97:02:00	0.43	.	10.5	.	5.0	.	0.75	.	0.21	.	2.63	.	0.01	.	0.16	.	638.8	.	.	.	47.6	.	.	.	7.7
3	23	7Nov97:05:00	0.57	0.5	11.0	11.5	5.0	4.5	0.63	0.68	0.15	0.15	2.29	2.3	0.03	0.03	0.16	0.19	630.8	604.5	.	.	43.7	43.9	.	.	9.7
3	23	7Nov97:08:00	0.82	.	11.5	.	5.0	.	0.61	.	0.15	.	2.05	.	0.01	.	0.17	.	642.3	.	.	.	43.2	.	.	.	18.6
3	23	7Nov97:11:00	0.65	0.66	8.0	7.0	3.5	3.5	0.89	0.68	0.17	0.16	2.23	1.57	0.02	0	0.19	0.17	624.3	611.3	.	.	44.4	43.4	.	.	20.4
3	23	7Nov97:14:00	0.54	0.56	8.8	11.2	4.0	2.8	0.55	0.55	0.14	0.16	1.59	1.72	0	0	0.17	0.17	629.8	647.9	.	.	40.6	41.3	.	.	21.1
3	23	7Nov97:17:00	0.68	0.5	8.0	8.8	3.2	3.2	0.54	0.53	0.13	0.13	1.42	1.38	0.01	0.03	0.18	0.17	632.7	638.4	.	.	41.3	39.8	.	.	20.6
3	23	7Nov97:20:00	0.41	.	9.2	.	3.6	.	0.55	.	0.13	.	1.56	.	0.02	.	0.18	.	647.6	.	.	.	41.7	.	.	.	20.4
3	23	7Nov97:23:00	0.69	.	7.2	.	2.0	.	0.34	.	0.1	.	1.57	.	0.01	.	0.2	.	1525.8	.	.	.	40.1	.	.	.	20.1
3	23	8Nov97:02:00	0.54	.	6.4	.	2.0	.	0.51	.	0.11	.	1.8	.	0.04	.	0.19	.	669	.	.	.	42.4	.	.	.	19.4
3	23	8Nov97:05:00	0.71	.	8.4	.	3.6	.	0.44	.	0.1	.	1.9	.	0	.	0.19	.	644.3	.	.	.	43.4	.	.	.	16.7
3	23	8Nov97:08:00	0.13	.	7.6	.	4.4	.	0.44	.	0.15	.	2.91	.	0.02	.	0.17	.	640.9	.	.	.	45.1	.	.	.	19.6
3	23	8Nov97:11:00	0.75	0.83	11.2	11.6	5.6	4.4	0.48	0.53	0.14	0.14	2.15	2.25	0	0.05	0.16	0.14	613.9	594.2	.	.	43.9	40.6	.	.	20.4
3	23	8Nov97:14:00	0.44	0.48	5.0	5.5	1.0	2.0	0.58	0.52	0.15	0.12	2	1.88	0.06	0	0.2	0.17	669.4	981.7	.	.	51	48.3	.	.	19.4
3	23	8Nov97:17:00	0.65	.	6.5	.	1.5	.	0.52	.	0.13	.	1.96	.	0.05	.	0.15	.	659.8	.	.	.	46.4	.	.	.	18.5
3	23	8Nov97:20:00	0.7	.	8.0	.	2.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.6
3	23	8Nov97:23:00	0.48	0.54	8.0	8.5	2.5	2.0	0.44	0.42	0.12	0.13	1.56	1.69	0.01	0.06	0.22	0.14	684.4	618.2	.	.	47.6	46.4	.	.	20.6
3	23	9Nov97:02:00	0.64	.	8.0	.	2.0	.	0.45	.	0.12	.	1.77	.	0.03	.	0.15	.	639.8	.	.	.	46.2	.	.	.	20.4
3	23	9Nov97:05:00	0.36	.	6.0	.	1.0	.	0.4	.	0.11	.	1.82	.	0.06	.	0.13	.	694.5	.	.	.	48.1	.	.	.	16.4
3	23	9Nov97:08:00	0.4	0.6	7.5	6.2	3.0	2.1	0.44	0.5	0.12	0.22	1.82	2.22	0.07	0.05	0.14	0.12	623.8	629.8	.	.	45.2	44.5	.	.	18.9
3	23	9Nov97:11:00	0.57	0.6	9.5	9.6	2.5	1.5	0.36	0.42	0.12	0.16	1.57	2	0.05	0.04	0.18	0.17	645.6	630.8	.	.	45.4	45.6	.	.	20.0
3	23	9Nov97:14:00	0.43	.	5.5	.	2.0	.	0.38	.	0.09	.	1.58	.	0	.	0.28	.	653.8	.	.	.	53	.	.	.	19.9
3	23	9Nov97:17:00	0.24	.	11.5	.	1.5	.	0.97	.	0.21	.	1.43	.	0	.	0.18	.	647	.	.	.	50.1	.	.	.	20.6
3	23	9Nov97:20:00	0.73	.	12.5	.	1.5	.	0.24	.	0.12	.	1.62	.	0.08	.	0.14	.	716.3	.	.	.	44.1	.	.	.	20.7
3	23	9Nov97:23:00	0.33	.	8.0	.	1.0	.	0.31	.	0.13	.	1.67	.	0.05	.	0.14	.	638.7	.	.	.	42.9	.	.	.	20.6
3	23	10Nov97:02:00	0.38	0.43	8.5	11.2	2.0	1.2	0.4	0.35	0.13	0.11	1.87	1.55	0.05	0.07	0.16	0.11	640.1	618.4	.	.	44.4	39.9	.	.	20.4
3	23	10Nov97:05:00	0.74	0.69	7.7	6.0	1.8	1.5	0.38	0.37	0.12	0.11	1.98	2.13	0.07	0.07	0.13	0.16	675.7	636.7	.	.	46.9	48.6	.	.	17.3
3	23	10Nov97:08:00	0.7	.	9.0	.	1.5	.	0.32	.	0.11	.	1.86	.	0.06	.	0.16	.	640.6	.	.	.	47	.	.	.	17.1
3	23	10Nov97:11:00	0.5	.	8.1	.	1.2	.	0.33	.	0.11	.	1.8	.	0	.	0.14	.	655.6	.	.	.	48.4	.	.	.	19.2
3	23	10Nov97:14:00	0.5	0.59	10.6	10.0	4.4	3.5	0.31	0.24	0.11	0.11	1.46	1.61	0.03	0.02	0.23	0.15	728.8	616.6	.	.	49.9	48.4	.	.	20.0
3	23	10Nov97:17:00	0.59	0.64	8.0	8.5	4.0	4.0	0.38	0.38	0.12	0.11	1.31	1.64	0.06	0.03	0.17	0.19	613.8	638.3	.	.	47.7	50.3	.	.	20.1
3	23	10Nov97:20:00	0.58	0.64	12.0	11.5	4.5	2.5	0.37	0.3	0.12	0.11	1.66	1.66	0.05	0.04	0.15	0.2	652.8	622.9	.	.	47	45.2	.	.	19.8
3	23	10Nov97:23:00	0.46	0.36	10.5	10.5	3.0	3.0	0.39	0.31	0.16	0.11	1.72	1.65	0.03	0	0.14	0.14	669.2	635.2	.	.	46.9	44.6	.	.	19.6
3	23	11Nov97:02:00	0.36	.	9.5	.	2.5	.	0.36	.	0.13	.	1.66	.	0.06	.	0.13	.	623.2	.	.	.	47	.	.	.	19.2
3	23	11Nov97:05:00	0.64	.	8.5	.	2.0	.	0.39	.	0.16	.	2.05	.	0.06	.	0.16	.	643.3	.	.	.	48.4	.	.	.	19.3
3	23	11Nov97:08:00	0.73	.	10.0	.	1.3	.	0.34	.	0.11	.	2.44	.	0.04	.	0.18	.	639.8	.	.	.	49.5	.	.	.	16.0
3	23	11Nov97:11:00	0.41	.	9.0	.	2.0	.	0.33	.	0.13	.	2.04	.	0.05	.	0.14	.	628.8	.	.	.	49.9	.	.	.	18.3
3	23	11Nov97:14:00	0.77	.	11.0	.	4.5	.	0.74	.	0.17	.	1.22	.	0.01	.	0.14	.	715.2	.	.	.	45.4	.	.	.	18.7
3	23	11Nov97:17:00	1.14	0.64	24.5	20.5	7.5	4.5	0.71	0.82	0.2	0.17	1.41	1.42	0.02	0.01	0.13	0.15	655.6	641.4	.	.	43.8	44.2	.	.	19.5
3	23	11Nov97:20:00	0.73	.	12.0	.	3.3	.	1.03	.	0.18	.	1.61	.	0.02	.	0.26	.	754	.	.	.	45.5	.	.	.	17.2
3	23	11Nov97:23:00	0.82	.	8.7	.	4.0	.	0.83	.	0.12	.	1.59	.	0.02	.	0.18	.	659.2	.	.	.	47.3	.	.	.	15.0
3	23	12Nov97:02:00	0.5	.	9.3	.	4.7	.	0.72	.	0.1	.	1.08	.	0.01	.	0.17	.	628.8	.	.	.	47.4	.	.	.	17.7
3	23	12Nov97:05:00	0.41	0.36	7.3	8.3	2.7	4.1	0.79	0.64	0.13	0.13	1.34	1.53	0	0.01	0.19	0.15	1068.3	642.8	.	.	49.1	43.4	.	.	17.1
3	23	12Nov97:08:00	0.64	.	6.0	.	4.0	.	0.89	.	0.1	.	1.42	.	0.01	.	0.14	.	711.3	.	.	.	43.6	.	.	.	14.8

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
3	23	12Nov97:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17.0
3	23	12Nov97:14:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.8
3	23	12Nov97:17:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.7
3	23	12Nov97:20:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.6
3	23	12Nov97:23:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.8
3	23	13Nov97:02:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.8
3	23	13Nov97:05:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18.5
3	23	13Nov97:08:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18.4
3	23	13Nov97:11:00	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18.6
3	23	13Nov97:14:00	0.68	.	13.5	.	3.0	.	0.49	.	0.14	.	0.75	.	0	.	0.16	.	690.3	.	.	.	41.2	.	.	.	19.3
3	23	13Nov97:17:00	0.55	0.59	14.0	11.5	5.0	3.0	0.54	0.52	0.15	0.17	1.14	1.39	0	0	0.13	0.18	676.2	677.4	.	.	41.3	46.8	.	.	19.7
3	23	13Nov97:20:00	0.64	.	7.3	.	6.0	.	0.99	.	0.18	.	1.76	.	0	.	0.16	.	676.3	.	.	.	53	.	.	.	19.9
3	23	13Nov97:23:00	0.5	.	9.3	.	2.7	.	0.62	.	0.15	.	1.2	.	0.01	.	0.18	.	663.9	.	.	.	53.3	.	.	.	20.0
3	23	14Nov97:02:00	0.73	.	9.3	.	2.0	.	0.48	.	0.19	.	0.88	.	0	.	0.19	.	650.8	.	.	.	51.5	.	.	.	20.4
3	23	14Nov97:05:00	0.55	.	8.5	.	2.0	.	0.4	.	0.15	.	1.12	.	0	.	0.14	.	669.2	.	.	.	47.5	.	.	.	20.2
3	23	14Nov97:08:00	0.5	0.91	9.0	7.4	2.5	2.6	0.5	0.53	0.17	0.14	1.21	1.03	0	0	0.14	0.14	653.6	658.4	.	.	45.1	46.3	.	.	20.2
3	23	14Nov97:11:00	0.27	.	7.5	.	2.5	.	0.32	.	0.23	.	1.04	.	0	.	0.15	.	653	.	.	.	44.6	.	.	.	20.2
3	23	14Nov97:14:00	0.54	0.51	8.0	7.4	3.0	3.7	0.45	0.6	0.16	0.1	0.82	0.7	0	0.01	0.15	0.14	681.8	666.7	.	.	46	46.1	.	.	20.3
3	23	14Nov97:17:00	0.43	0.49	10.0	13.0	3.0	3.0	0.65	0.71	0.1	0.11	0.8	0.85	0.02	0.02	0.16	0.15	637.4	646.5	.	.	44.4	46	.	.	19.4
3	23	14Nov97:20:00	0.63	.	9.5	.	2.5	.	1.08	.	0.13	.	0.92	.	0.02	.	0.16	.	647	.	.	.	44.2	.	.	.	19.0
3	23	14Nov97:23:00	0.46	.	7.5	.	2.5	.	0.85	.	0.12	.	0.88	.	0.01	.	0.17	.	657.4	.	.	.	45	.	.	.	19.0
3	23	15Nov97:02:00	7.65	.	6.5	.	3.0	.	0.9	.	0.12	.	0.94	.	0.03	.	0.17	.	653.5	.	.	.	44.8	.	.	.	18.9
3	23	15Nov97:05:00	0.46	0.56	7.0	6.3	2.0	2.1	0.89	0.75	0.19	0.11	1.11	1.15	0	0.02	0.17	0.15	658.3	647.5	.	.	44.4	46	.	.	18.8
3	23	15Nov97:08:00	0.49	0.67	4.5	6.0	1.0	1.0	2.1	1.51	0.07	0.1	1.05	1.39	0.02	0.02	0.17	0.18	688.6	766.4	.	.	44.1	47.2	.	.	16.4
3	23	15Nov97:11:00	0.71	.	5.0	.	1.5	.	1.72	.	0.05	.	0.85	.	0.03	.	0.25	.	973.3	.	.	.	47.8	.	.	.	13.5
3	23	15Nov97:14:00	1.02	.	6.5	.	2.5	.	1.7	.	0.08	.	0.76	.	0.03	.	0.32	.	1180.8	.	.	.	47.8	.	.	.	13.6
3	23	15Nov97:17:00	0.93	.	5.5	.	1.5	.	1.52	.	0.04	.	0.64	.	0.03	.	0.11	.	742.3	.	.	.	49.2	.	.	.	13.5
3	23	15Nov97:20:00	0.74	.	6.5	.	2.0	.	1.8	.	0.06	.	0.77	.	0	.	0.21	.	766	.	.	.	52.1	.	.	.	13.6
3	23	15Nov97:23:00	0.98	.	6.0	.	1.0	.	1.62	.	0.04	.	0.85	.	0.01	.	0.14	.	750.9	.	.	.	47.2	.	.	.	13.5
3	23	16Nov97:02:00	0.97	0.97	4.5	4.5	2.5	2.0	1.49	1.31	0.07	0.07	0.98	1.06	0.01	0.02	0.18	0.18	754.9	727.8	.	.	50.7	51	.	.	13.7
3	23	16Nov97:05:00	0.97	.	7.0	.	4.0	.	1.09	.	0.07	.	1.02	.	0.02	.	0.13	.	728.2	.	.	.	48.7	.	.	.	13.6
3	23	16Nov97:08:00	0.92	1.08	5.5	5.5	3.5	2.0	1.15	0.99	0.09	0.07	1.3	1.16	0.02	0.02	0.28	0.28	728.7	743.4	.	.	49.1	51.8	.	.	13.7
3	23	16Nov97:11:00	0.56	.	5.5	.	2.0	.	1.03	.	0.08	.	1.09	.	0	.	0.36	.	743.2	.	.	.	50.8	.	.	.	13.5
3	23	16Nov97:14:00	1.21	1.18	7.5	9.0	2.5	2.5	1	1.01	0.09	0.11	1.06	1.11	0.01	0.02	0.35	0.24	763.9	738.4	.	.	48.7	50.1	.	.	13.3
2	25	6Jan98:17:00	1.18	.	3.5	.	3.5	.	2.45	.	0.19	.	3.82	.	0.08	.	0.4	.	885.8	.	.	.	52.6	.	.	.	0.9
2	25	6Jan98:20:00	1	1.05	4.5	5.5	3.0	3.0	2.09	1.74	0.17	0.17	3.34	3.27	0.02	0	0.38	0.35	886.7	925	.	.	.	63.6	.	.	0.6
2	25	6Jan98:23:00	0.73	.	3.5	.	1.0	.	1.97	.	0.17	.	3.37	.	0.05	.	0.39	.	876.7	.	.	.	65.1	.	.	.	0.7
2	25	7Jan98:02:00	0.73	.	2.5	.	2.0	.	1.96	.	0.17	.	3.4	.	0.01	.	0.39	.	876.7	.	.	.	63.8	.	.	.	1.1
2	25	7Jan98:05:00	0.41	0.91	3.5	5.0	2.5	3.0	1.93	1.89	0.17	0.18	3.69	3.74	0.03	0.03	0.4	0.33	872.5	958.3	.	.	70.8	60.6	.	.	0.7
2	25	7Jan98:08:00	0.64	.	4.5	.	3.5	.	1.94	.	0.2	.	3.83	.	0.07	.	0.33	.	926.7	.	.	.	60.8	.	.	.	0.6
2	25	7Jan98:11:00	1.55	.	1.5	.	2.0	.	1.9	.	0.17	.	3.7	.	0.02	.	0.36	.	951.7	.	.	.	59.9	.	.	.	0.8
2	25	7Jan98:14:00	0.91	1.37	2.5	3.0	1.0	2.5	1.9	1.89	0.19	0.19	3.6	3.78	0.04	0.01	0.31	0.48	968.3	863.3	.	.	65.4	63.7	.	.	0.6
2	25	7Jan98:17:00	0.91	.	5.0	.	4.0	.	1.86	.	0.18	.	3.08	.	0	.	0.43	.	968.3	.	.	.	65.6	.	.	.	0.6
2	25	7Jan98:20:00	1	.	3.5	.	1.5	.	1.75	.	0.19	.	3.48	.	0.07	.	0.34	.	935	.	.	.	59.8	.	.	.	0.6
2	25	7Jan98:23:00	0.96	1	1.0	3.0	2.0	2.0	1.89	1.82	0.19	0.18	3.1	3.26	0.04	0.01	0.46	0.36	891.7	895.8	.	.	70	64.9	.	.	0.6
2	25	8Jan98:02:00	0.82	.	3.5	.	2.5	.	1.89	.	0.18	.	3.24	.	0.03	.	0.35	.	907.5	.	.	.	59.5	.	.	.	0.6
2	25	8Jan98:05:00	0.87	.	2.5	.	1.5	.	1.84	.	0.19	.	3.26	.	0	.	0.37	.	907.5	.	.	.	59.2	.	.	.	0.6
2	25	8Jan98:08:00	1.28	.	3.5	.	1.0	.	1.81	.	0.2	.	3.64	.	0.06	.	0.39	.	870	.	.	.	64.2	.	.	.	0.6
2	25	8Jan98:11:00	1.46	.	2.0	.	1.5	.	1.86	.	0.19	.	3.54	.	0.01	.	0.37	.	942.5	.	.	.	63.3	.	.	.	0.6
2	25	8Jan98:14:00	1.46	.	11.5	.	4.0	.	2.76	.	0.56	.	4.81	.	0.02	.	0.57	.	901.7	.	.	.	65.1	.	.	.	0.9
2	25	8Jan98:17:00	1.46	.	3.5	.	3.0	.	1.89	.	0.19	.	2.88	.	0.03	.	0.62	.	960	.	.	.	69.1	.	.	.	0.6

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	25	8Jan98:20:00	1.37	.	2.5	.	3.5	.	1.87	.	0.25	.	3.1	.	0.03	.	0.42	.	965	.	.	.	65.5	.	.	.	0.6
2	25	8Jan98:23:00	1.64	1	6.5	7.5	4.0	4.5	1.85	1.88	0.21	0.2	2.99	3.14	0.02	0.05	0.49	0.47	968.3	965	.	.	61.1	65.6	.	.	0.6
2	25	9Jan98:02:00	1	.	4.5	.	2.0	.	1.92	.	0.18	.	3.37	.	0.04	.	0.54	.	959.2	.	.	.	79.8	.	.	.	1.5
2	25	9Jan98:05:00	1.09	.	4.5	.	2.5	.	1.99	.	0.32	.	3.47	.	0.05	.	0.36	.	926.7	.	.	.	63.9	.	.	.	1.7
2	25	9Jan98:08:00	1.64	.	5.0	.	2.5	.	1.86	.	0.2	.	3.83	.	0.01	.	0.4	.	991.7	.	.	.	61.8	.	.	.	1.8
2	25	9Jan98:11:00	2.92	.	7.5	.	4.0	.	2.07	.	0.23	.	4.53	.	0.03	.	0.62	.	945	.	.	.	68.3	.	.	.	2.4
2	25	9Jan98:14:00	1.91	.	4.0	.	2.0	.	2.01	.	0.21	.	3.79	.	0	.	0.37	.	919.2	.	.	.	55.2	.	.	.	2.7
2	25	9Jan98:17:00	1.82	.	2.0	.	2.0	.	1.86	.	0.23	.	3.85	.	0	.	0.39	.	904.2	.	.	.	58.4	.	.	.	2.5
2	25	9Jan98:20:00	1.46	.	6.0	.	4.0	.	2.01	.	0.22	.	3.79	.	0.02	.	0.49	.	902.5	.	.	.	58.4	.	.	.	3.5
2	25	9Jan98:23:00	0.73	0.73	5.5	4.0	4.0	2.5	1.98	1.99	0.23	0.28	3.78	4.02	0.05	0.07	0.38	0.36	934.2	850.8	.	.	54.9	54	.	.	1.6
2	25	10Jan98:02:00	1.46	.	4.5	.	2.0	.	3.38	.	0.55	.	7.8	.	0.02	.	0.36	.	913.3	.	.	.	53.3	.	.	.	1.5
2	25	10Jan98:05:00	0.23	.	4.0	.	2.5	.	1.95	.	0.23	.	4.37	.	0.08	.	0.38	.	897.5	.	.	.	56	.	.	.	1.0
2	25	10Jan98:08:00	1.82	.	7.5	.	5.5	.	1.84	.	0.2	.	4.7	.	0.03	.	0.44	.	920.8	.	.	.	56.9	.	.	.	0.6
2	25	10Jan98:11:00	2.19	.	5.0	.	2.5	.	1.88	.	0.24	.	4.65	.	0.03	.	0.54	.	903.3	.	.	.	61	.	.	.	0.6
2	25	10Jan98:14:00	0.27	.	2.5	.	2.0	.	1.83	.	0.2	.	4.42	.	0	.	0.38	.	1760	.	.	.	58	.	.	.	1.0
2	25	10Jan98:17:00	1.05	.	4.5	.	2.5	.	1.94	.	0.23	.	4.32	.	0.01	.	0.38	.	1210.8	.	.	.	57	.	.	.	1.3
2	25	10Jan98:20:00	1.64	1.64	5.0	5.5	3.0	3.0	1.83	1.79	0.22	0.21	4.23	4.24	0.02	0.02	0.45	0.6	909.2	925.8	.	.	59.2	60.2	.	.	0.8
2	25	10Jan98:23:00	1.46	.	4.0	.	2.5	.	1.81	.	0.24	.	4.41	.	0.02	.	0.38	.	902.5	.	.	.	61.4	.	.	.	0.6
2	25	11Jan98:02:00	0.09	.	6.5	.	4.5	.	1.77	.	0.25	.	4.74	.	0.02	.	0.4	.	895.8	.	.	.	58.6	.	.	.	0.7
2	25	11Jan98:05:00	1	.	5.5	.	3.0	.	1.82	.	0.24	.	4.97	.	0.04	.	0.58	.	910.8	.	.	.	65.7	.	.	.	0.6
2	25	11Jan98:08:00	1.64	.	5.0	.	2.5	.	1.75	.	0.22	.	5.03	.	0.03	.	0.34	.	889.2	.	.	.	58.3	.	.	.	0.6
2	25	11Jan98:11:00	1.28	.	2.5	.	2.5	.	1.83	.	0.21	.	5.14	.	0.04	.	0.46	.	918.3	.	.	.	60	.	.	.	0.6
2	25	11Jan98:14:00	0.41	.	3.5	.	4.5	.	1.9	.	0.25	.	4.91	.	0.08	.	0.3	.	940.8	.	.	.	56.1	.	.	.	1.0
2	25	11Jan98:17:00	0.73	.	2.5	.	3.5	.	1.88	.	0.23	.	4.65	.	0.03	.	0.45	.	1258.3	.	.	.	61.9	.	.	.	1.4
2	25	11Jan98:20:00	1.28	.	6.0	.	5.0	.	1.81	.	0.19	.	4.54	.	0.03	.	0.45	.	1024.2	.	.	.	61.6	.	.	.	0.7
2	25	11Jan98:23:00	0.55	.	3.5	.	2.0	.	1.74	.	0.19	.	4.5	.	0.01	.	0.41	.	1223.3	.	.	.	56.4	.	.	.	0.7
2	25	12Jan98:02:00	1	.	4.5	.	4.0	.	1.78	.	0.21	.	4.83	.	0.08	.	0.37	.	1103.3	.	.	.	62.2	.	.	.	0.8
2	25	12Jan98:05:00	0.73	1.18	5.0	4.0	2.5	3.5	1.73	1.76	0.22	0.23	5.04	5.12	0	0.02	0.31	0.33	889.2	877.5	.	.	58.5	60.6	.	.	0.9
2	25	12Jan98:08:00	1.37	.	9.5	.	3.5	.	1.65	.	0.18	.	5.12	.	0.02	.	0.45	.	908.3	.	.	.	59.3	.	.	.	0.9
2	25	12Jan98:11:00	1.46	.	3.0	.	2.5	.	1.74	.	0.2	.	5.33	.	0	.	0.37	.	980.8	.	.	.	59.6	.	.	.	1.2
2	25	12Jan98:14:00	1.18	.	10.5	.	4.0	.	1.73	.	0.21	.	4.87	.	0.04	.	0.37	.	893.3	.	.	.	55.2	.	.	.	1.1
2	25	12Jan98:17:00	0.59	.	4.0	.	2.0	.	1.91	.	0.24	.	4.82	.	0.03	.	0.29	.	878.3	.	.	.	58.6	.	.	.	0.8
2	25	12Jan98:20:00	1.96	.	3.0	.	2.0	.	1.7	.	0.22	.	4.46	.	0.04	.	0.47	.	865.8	.	.	.	61.3	.	.	.	0.6
2	25	12Jan98:23:00	0.91	.	4.0	.	4.5	.	1.67	.	0.18	.	4.67	.	0	.	0.28	.	866.7	.	.	.	56.4	.	.	.	0.6
2	25	13Jan98:02:00	0.77	.	3.5	.	3.5	.	1.71	.	0.23	.	5.26	.	0.01	.	0.42	.	910	.	.	.	59.6	.	.	.	0.8
2	25	13Jan98:05:00	0.77	.	3.0	.	3.5	.	1.67	.	0.19	.	4.91	.	0	.	0.28	.	886.7	.	.	.	57.3	.	.	.	1.2
2	25	13Jan98:08:00	0.09	0.91	6.0	3.5	3.0	2.5	1.59	1.62	0.17	0.19	4.9	5.1	0	0.02	0.35	0.53	870	888.3	.	.	58	64.4	.	.	0.8
2	25	13Jan98:11:00	1.73	.	2.5	.	2.0	.	1.63	.	0.2	.	5.14	.	0.02	.	0.34	.	875	.	.	.	58.8	.	.	.	0.8
2	25	13Jan98:14:00	1.28	.	1.0	.	1.5	.	1.77	.	0.2	.	4.72	.	0.01	.	0.45	.	871.7	.	.	.	66.6	.	.	.	1.6
2	25	13Jan98:17:00	0.77	.	3.5	.	2.5	.	1.58	.	0.21	.	4.47	.	0.04	.	0.31	.	920.8	.	.	.	57	.	.	.	1.3
2	25	13Jan98:20:00	1.14	.	4.0	.	2.5	.	1.64	.	0.24	.	4.25	.	0.01	.	0.35	.	895	.	.	.	62.8	.	.	.	1.0
2	25	13Jan98:23:00	0.96	.	2.5	.	0.5	.	1.62	.	0.2	.	4.25	.	0	.	0.46	.	894.2	.	.	.	60.2	.	.	.	1.2
2	25	14Jan98:02:00	0.64	.	2.5	.	2.0	.	1.68	.	0.21	.	4.44	.	0.02	.	0.38	.	927.5	.	.	.	0	.	.	.	1.6
2	25	14Jan98:05:00	1	.	4.0	.	3.0	.	1.62	.	0.21	.	4.56	.	0	.	0.37	.	865	.	.	.	0	.	.	.	1.1
2	25	14Jan98:08:00	0.55	1.28	5.5	4.0	3.5	3.0	1.57	1.6	0.2	0.21	5.05	5.03	0.03	0.02	0.41	0.43	888.3	870.8	.	.	68.2	64.1	.	.	0.7
2	25	14Jan98:11:00	1.64	.	4.5	.	2.0	.	1.17	.	0.14	.	4.86	.	0.02	.	0.41	.	854.2	.	.	.	67.7	.	.	.	1.0
2	25	14Jan98:14:00	1.09	.	1.5	.	1.5	.	1.08	.	0.16	.	5.96	.	0.02	.	0.41	.	887.5	.	.	.	62.2	.	.	.	1.5
2	25	14Jan98:17:00	1.46	1.46	3.5	2.5	2.0	1.5	1.17	1.27	0.13	0.16	4.07	5.09	0.01	0.02	0.34	0.3	895	930	.	.	60	60	.	.	1.4
2	25	14Jan98:20:00	1.18	.	3.5	.	0.0	.	1.15	.	0.14	.	4.2	.	0	.	0.3	.	935	.	.	.	57.4	.	.	.	0.9
2	25	14Jan98:23:00	0.82	.	3.0	.	2.0	.	0.84	.	0.11	.	3.6	.	0	.	0.49	.	910.8	.	.	.	62.6	.	.	.	0.7
2	25	15Jan98:02:00	0.82	.	3.5	.	3.0	.	0.97	.	0.14	.	3.49	.	0.04	.	0.33	.	905	.	.	.	60.9	.	.	.	1.1

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cr	mo	datime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	25	15Jan98:05:00	1.05	.	3.5	.	3.0	.	1.65	.	0.19	.	4.62	.	0.02	.	0.5	.	875	.	.	.	68.8	.	.	.	1.3
2	25	15Jan98:08:00	0.59	.	4.5	.	3.0	.	1.76	.	0.24	.	5.04	.	0.03	.	0.37	.	840	.	.	.	59.8	.	.	.	0.8
2	25	15Jan98:11:00	0.23	.	2.0	.	2.0	.	1.57	.	0.19	.	4.79	.	0.03	.	0.33	.	951.7	.	.	.	62.4	.	.	.	0.8
2	25	15Jan98:14:00	1.55	.	7.0	.	3.0	.	1.72	.	0.19	.	4.82	.	0.02	.	0.31	.	875	.	.	.	62	.	.	.	0.9
2	25	15Jan98:17:00	1.55	.	3.0	.	2.5	.	1.36	.	0.16	.	4.57	.	0.03	.	0.35	.	880	.	.	.	57.5	.	.	.	0.6
2	25	15Jan98:20:00	1.46	.	3.0	.	0.5	.	0.98	.	0.15	.	3.52	.	0	.	0.35	.	881.7	.	.	.	63.8	.	.	.	0.6
2	25	15Jan98:23:00	1.37	.	5.0	.	4.5	.	1.21	.	0.16	.	3.67	.	0.02	.	0.31	.	852.5	.	.	.	66.4	.	.	.	0.6
2	25	16Jan98:02:00	0.73	.	3.0	.	2.0	.	1.13	.	0.12	.	3.32	.	0	.	0.3	.	834.2	.	.	.	60.8	.	.	.	0.8
2	25	16Jan98:05:00	1	.	3.5	.	2.5	.	1.77	.	0.18	.	4	.	0.03	.	0.62	.	849.2	.	.	.	65.7	.	.	.	0.6
2	25	16Jan98:08:00	1.46	.	3.5	.	2.5	.	1.48	.	0.19	.	4.78	.	0.02	.	0.63	.	923.3	.	.	.	60.5	.	.	.	0.7
2	25	16Jan98:11:00	2	2	5.0	4.5	2.0	2.0	1.52	1.43	0.18	0.14	4.92	4.97	0	0.02	0.38	0.31	921.7	969.2	.	.	65.8	57	.	.	1.0
2	25	16Jan98:14:00	2	.	3.5	.	3.5	.	1.68	.	0.17	.	5.13	.	0.01	.	0.47	.	888.3	.	.	.	64.7	.	.	.	0.6
2	29	14May98:20:00	.	.	.	.	.	.	0.91	.	0.26	.	7.12	.	0.04	.	0.38	.	817.8	.	.	.	60.6	.	.	.	16.1
2	29	14May98:23:00	.	.	.	.	.	.	1.35	1.33	0.3	0.26	7.93	8.13	0.05	0.05	0.36	0.37	778.3	773.3	.	.	56.3	60.6	.	.	16.1
2	29	15May98:02:00	.	.	.	.	.	.	1.3	.	0.21	.	8.02	.	0	.	0.39	.	793.3	.	.	.	55	.	.	.	16.0
2	29	15May98:05:00	.	.	.	.	.	.	1.23	.	0.21	.	7.28	.	0.05	.	0.34	.	783.1	.	.	.	57.8	.	.	.	15.8
2	29	15May98:08:00	.	.	.	.	.	.	1.15	.	0.16	.	6.29	.	0.01	.	0.38	.	803.3	.	.	.	58.5	.	.	.	15.6
2	29	15May98:11:00	.	.	.	.	.	.	0.98	.	0.06	.	3.94	.	0.08	.	0.36	.	814.2	.	.	.	56.5	.	.	.	15.6
2	29	15May98:14:00	.	.	.	.	.	.	0.9	.	0.09	.	4.06	.	0.07	.	0.4	.	871.7	.	.	.	57.2	.	.	.	15.6
2	29	15May98:17:00	.	.	.	.	.	.	0.93	.	0.18	.	5.63	.	0.08	.	0.4	.	764.2	.	.	.	61.9	.	.	.	15.8
2	29	15May98:20:00	.	.	.	.	.	.	0.96	.	0.21	.	6.2	.	0.1	.	0.27	.	728.3	.	.	.	56.8	.	.	.	15.8
2	29	15May98:23:00	.	.	.	.	.	.	3.83	.	0.57	.	8.52	.	0.62	.	0.3	.	736.7	.	.	.	62.5	.	.	.	15.8
2	29	16May98:02:00	.	.	.	.	.	.	1.3	.	0.19	.	5.42	.	0.03	.	0.31	.	850.8	.	.	.	58.6	.	.	.	15.7
2	29	16May98:05:00	.	.	.	.	.	.	0.92	.	0.1	.	4.57	.	0.01	.	0.37	.	780.8	.	.	.	56.3	.	.	.	15.6
2	29	16May98:08:00	.	.	.	.	.	.	0.65	.	0.12	.	4.01	.	0.02	.	0.29	.	802.5	.	.	.	55.3	.	.	.	15.5
2	29	16May98:11:00	.	.	.	.	.	.	0.74	.	0.09	.	4.18	.	0	.	0.42	.	847.9	.	.	.	56.5	.	.	.	15.3
2	29	16May98:14:00	.	.	.	.	.	.	0.73	1.12	0.11	0.86	6.04	5.61	0	0.01	0.45	0.35	827.5	866.7	.	.	59.7	53.1	.	.	15.4
2	29	16May98:17:00	.	.	.	.	.	.	1.66	.	0.15	.	6.76	.	0	.	0.43	.	804.2	.	.	.	59	.	.	.	15.6
2	29	16May98:20:00	.	.	.	.	.	.	0.94	.	0.15	.	16.8	.	0.01	.	0.31	.	840.8	.	.	.	61.8	.	.	.	15.6
2	29	16May98:23:00	.	.	.	.	.	.	1.48	.	0.13	.	6.86	.	0.03	.	0.34	.	810.8	.	.	.	56.7	.	.	.	15.6
2	29	17May98:02:00	.	.	.	.	.	.	1.32	.	0.11	.	4.99	.	0.09	.	0.39	.	838.3	.	.	.	60.7	.	.	.	15.5
2	29	17May98:05:00	.	.	.	.	.	.	2.14	1.36	0.1	0.1	5.53	3.82	0.12	0.02	0.45	0.54	855	827.9	.	.	61.2	61.6	.	.	15.4
2	29	17May98:08:00	.	.	.	.	.	.	2.67	.	0.09	.	6.87	.	0.01	.	0.44	.	858.3	.	.	.	63.7	.	.	.	15.3
2	29	17May98:11:00	.	.	.	.	.	.	3.54	.	0.08	.	5.5	.	0.04	.	0.57	.	841.7	.	.	.	67.2	.	.	.	15.3
2	29	17May98:14:00	.	.	.	.	.	.	0.7	.	0.1	.	3.21	.	0.01	.	0.5	.	852.5	.	.	.	62.5	.	.	.	15.4
2	29	17May98:17:00	.	.	.	.	.	.	1.66	.	0.27	.	9.12	.	0.52	.	0.48	.	849.2	.	.	.	60.7	.	.	.	15.5
2	29	17May98:20:00	.	.	.	.	.	.	0.76	.	0.14	.	3.85	.	0.04	.	0.41	.	830	.	.	.	61.6	.	.	.	15.7
2	29	17May98:23:00	.	.	.	.	.	.	0.99	1	0.14	0.15	5.39	5.12	0.11	0.04	0.42	0.38	855	842.5	.	.	60.3	59.1	.	.	15.5
2	29	18May98:02:00	.	.	.	.	.	.	0.71	.	0.1	.	9.31	.	0.02	.	0.4	.	858.3	.	.	.	62.9	.	.	.	15.5
2	29	18May98:05:00	.	.	.	.	.	.	0.83	.	0.1	.	7.72	.	0.02	.	0.43	.	850	.	.	.	58.6	.	.	.	15.4
2	29	18May98:08:00	.	.	.	.	.	.	0.67	.	0.09	.	4.73	.	0.06	.	0.48	.	845.8	.	.	.	64.5	.	.	.	15.3
2	29	18May98:11:00	.	.	.	.	.	.	0.61	.	0.1	.	5.18	.	0.01	.	0.44	.	803.3	.	.	.	60.9	.	.	.	15.6
2	29	18May98:14:00	.	.	.	.	.	.	0.94	.	0.21	.	6.49	.	0.08	.	0.33	.	786.7	.	.	.	63	.	.	.	16.3
2	29	18May98:17:00	.	.	.	.	.	.	0.52	.	0.16	.	3.91	.	0.05	.	0.2	.	776.8	.	.	.	57.4	.	.	.	16.4
2	29	18May98:20:00	.	.	.	.	.	.	0.62	0.6	0.13	0.15	4.35	4.35	0.05	0.04	0.3	0.39	785.8	790	.	.	56.9	58.5	.	.	16.5
2	29	18May98:23:00	.	.	.	.	.	.	0.72	.	0.18	.	5.61	.	0	.	0.29	.	771.7	.	.	.	57.1	.	.	.	16.4
2	29	19May98:02:00	.	.	.	.	.	.	0.77	.	0.15	.	4.82	.	0.04	.	0.31	.	790.8	.	.	.	58.7	.	.	.	16.5
2	29	19May98:05:00	.	.	.	.	.	.	0.74	.	0.1	.	.	.	0.04	.	0.5	.	828.3	.	.	.	61.9	.	.	.	16.1
2	29	19May98:08:00	.	.	.	.	.	.	0.66	.	0.15	.	6.61	.	0.07	.	0.52	.	816.7	.	.	.	61.4	.	.	.	15.9
2	29	19May98:11:00	.	.	.	.	.	.	0.51	.	0.17	.	5.19	.	0.08	.	0.31	.	780	.	.	.	58.5	.	.	.	16.4
2	29	19May98:14:00	.	.	.	.	.	.	0.73	.	0.17	.	5.17	.	0.06	.	0.15	.	757.5	.	.	.	53.4	.	.	.	16.5

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cr	mo	dattime	chl1	chl2	tss1	tss2	om1	om2	no31	no32	no21	no22	nh41	nh42	srp1	srp2	tp1	tp2	toc1	toc2	doc1	doc2	tn1	tn2	don1	don2	usgssal
2	29	19May98:17:00	.	.	.	.	.	.	0.58	.	0.35	.	5.05	.	0.11	.	0.28	.	797.6	.	.	.	59.9	.	.	.	16.3
2	29	19May98:20:00	.	.	.	.	.	.	0.69	.	0.08	.	3.74	.	0.07	.	0.22	.	808.5	.	.	.	61.6	.	.	.	16.1
2	29	19May98:23:00	.	.	.	.	.	.	0.69	.	0.16	.	4.99	.	0.07	.	0.3	.	801.1	.	.	.	55.3	.	.	.	16.3
2	29	20May98:02:00	.	.	.	.	.	.	0.74	0.71	0.15	0.14	6	8.52	0.06	0.07	0.15	0.22	910	1037.5	.	.	60.6	58.6	.	.	16.4
2	29	20May98:05:00	.	.	.	.	.	.	1.25	.	0.16	.	4.11	.	0.11	.	0.15	.	1525.8	.	.	.	54.4	.	.	.	16.3
2	29	20May98:08:00	.	.	.	.	.	.	0.39	.	0.1	.	6.49	.	0	.	0.22	.	824.4	.	.	.	64.5	.	.	.	16.4
2	29	20May98:11:00	.	.	.	.	.	.	0.35	.	0.12	.	6.8	.	0.04	.	0.15	.	792.3	.	.	.	55.1	.	.	.	16.4
2	29	20May98:14:00	.	.	.	.	.	.	0.3	.	0.12	.	5.94	.	0.03	.	0.34	.	810.8	.	.	.	58.4	.	.	.	16.6
2	29	20May98:17:00	.	.	.	.	.	.	0.45	.	0.15	.	5.39	.	0.04	.	0.38	.	810	.	.	.	60.9	.	.	.	16.6
2	29	20May98:20:00	.	.	.	.	.	.	1.53	.	0.14	.	4.85	.	0.09	.	0.28	.	819.2	.	.	.	59.1	.	.	.	16.3
2	29	20May98:23:00	.	.	.	.	.	.	1.66	.	0.12	.	7.32	.	0.06	.	0.23	.	814.2	.	.	.	57	.	.	.	16.1
2	29	21May98:02:00	.	.	.	.	.	.	1.88	.	0.18	.	6.92	.	0.05	.	0.29	.	808.3	.	.	.	66.4	.	.	.	16.2
2	29	21May98:05:00	.	.	.	.	.	.	1.77	.	0.19	.	7.56	.	0.03	.	0.41	.	814.2	.	.	.	65.5	.	.	.	16.1
2	29	21May98:08:00	.	.	.	.	.	.	1.68	.	0.19	.	11.8	.	0.05	.	0.33	.	812.5	.	.	.	62.9	.	.	.	16.0
2	29	21May98:11:00	.	.	.	.	.	.	1.64	.	0.17	.	9.07	.	0.07	.	0.47	.	825.8	.	.	.	63.8	.	.	.	15.9
2	29	21May98:14:00	.	.	.	.	.	.	1.63	.	0.17	.	9.39	.	0.08	.	0.54	.	813.3	.	.	.	72	.	.	.	16.0
2	29	21May98:17:00	.	.	.	.	.	.	1.19	.	0.2	.	7.63	.	0.08	.	0.26	.	802.5	.	.	.	59.2	.	.	.	16.2
2	29	21May98:20:00	.	.	.	.	.	.	1.81	1.72	0.22	0.19	7.47	4.01	0.1	0.17	0.19	0.3	794.2	771.7	.	.	54.9	58.5	.	.	16.3
2	29	21May98:23:00	.	.	.	.	.	.	2.1	.	0.21	.	6.25	.	0.13	.	0.33	.	783.3	.	.	.	62	.	.	.	16.2
2	29	22May98:02:00	.	.	.	.	.	.	2.69	.	0.22	.	7.85	.	0.16	.	0.47	.	825	.	.	.	65.9	.	.	.	16.1
2	29	22May98:05:00	.	.	.	.	.	.	2.33	.	0.15	.	6.52	.	0.12	.	0.39	.	820.8	.	.	.	61.7	.	.	.	16.1
2	29	22May98:08:00	.	.	.	.	.	.	2.06	.	0.15	.	7.68	.	0.15	.	0.47	.	825	.	.	.	67.8	.	.	.	16.2
2	29	22May98:11:00	.	.	.	.	.	.	2.09	.	0.16	.	7.91	.	0.19	.	0.42	.	850.8	.	.	.	66.4	.	.	.	16.3
2	29	22May98:14:00	.	.	.	.	.	.	1.52	.	0.27	.	5.33	.	0.15	.	0.26	.	747.5	.	.	.	59.3	.	.	.	17.0
2	29	22May98:17:00	.	.	.	.	.	.	1.59	.	0.18	.	4.61	.	0.16	.	0.28	.	761.7	.	.	.	59.9	.	.	.	16.8
2	29	22May98:20:00	.	.	.	.	.	.	1.64	.	0.18	.	4.09	.	0.15	.	0.12	.	756.7	.	.	.	55.4	.	.	.	17.0
2	29	22May98:23:00	.	.	.	.	.	.	1.43	.	0.18	.	4.23	.	0.14	.	0.19	.	792.7	.	.	.	59.3	.	.	.	17.1
2	29	23May98:02:00	.	.	.	.	.	.	1.3	.	0.22	.	4.73	.	0.16	.	0.23	.	754.2	.	.	.	58.1	.	.	.	17.1
2	29	23May98:05:00	.	.	.	.	.	.	1.21	1.3	0.2	0.19	5.06	4.97	0.16	0.13	0.2	0.17	755.8	749.6	.	.	57.4	62.5	.	.	17.2
2	29	23May98:08:00	.	.	.	.	.	.	1.28	.	0.21	.	4.61	.	0.2	.	0.2	.	750.8	.	.	.	.	.	.	.	16.7
2	29	23May98:11:00	.	.	.	.	.	.	1.72	.	0.21	.	6.85	.	0.12	.	0.67	.	826.7	.	.	.	.	.	.	.	17.1
2	29	23May98:14:00	.	.	.	.	.	.	1.27	.	0.25	.	7.73	.	0.15	.	0.43	.	761.7	.	.	.	.	.	.	.	18.1
2	29	23May98:17:00	.	.	.	.	.	.	1.33	.	0.19	.	5.71	.	0.12	.	0.28	.	755	.	.	.	.	.	.	.	18.2
2	29	23May98:20:00	.	.	.	.	.	.	1.33	.	0.23	.	5.07	.	0.17	.	0.5	.	753.3	.	.	.	.	.	.	.	18.3
2	29	23May98:23:00	.	.	.	.	.	.	1.27	.	0.17	.	3.86	.	0.23	.	0.61	.	748.3	.	.	.	57.9	.	.	.	18.4
2	29	24May98:02:00	.	.	.	.	.	.	1.35	1.31	0.28	0.29	4.83	5.37	0.14	0.15	0.49	0.19	892.5	810.8	.	.	58.5	52.4	.	.	18.5
2	29	24May98:05:00	.	.	.	.	.	.	1.29	.	0.2	.	3.2	.	0.2	.	0.21	.	825.8	.	.	.	52.4	.	.	.	18.5
2	29	24May98:08:00	.	.	.	.	.	.	1.51	.	0.23	.	4.58	.	0.2	.	0.23	.	794.2	.	.	.	53.6	.	.	.	18.1
2	29	24May98:11:00	.	.	.	.	.	.	1.41	.	0.15	.	6	.	0.2	.	0.31	.	775	.	.	.	53.7	.	.	.	18.3
2	29	24May98:14:00	.	.	.	.	.	.	1.09	.	0.14	.	4.83	.	0.16	.	0.34	.	750.8	.	.	.	58.7	.	.	.	18.5
2	29	24May98:17:00	.	.	.	.	.	.	1.43	.	0.22	.	4.57	.	0.12	.	0.28	.	762.5	.	.	.	56.7	.	.	.	18.6

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II. Taylor River Daily Water Sampling Data Set

This data set contains the daily total nitrogen (TN), total phophorus (TP), and total water flux from Taylor River for the period of 5/1/96 through 5/31/98. Each line represents a day. A "." indicates missing data.

Variable	Explanation/Comments
date	Date
sal	Salinity of water sample (ppt)
tp	TP (uM)
tn	TN (uM)
h20flx	Total daily water flux from Taylor River. Negative indicates flow to wetland

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Date	Salinity	TP	TN	h20flx
5/1/96	17	0.29	40.14	-42854
5/2/96	17	0.51	40.93	-61528
5/3/96	17	0.26	59.14	-71874
5/4/96	16	0.25	59.57	-60707
5/5/96	17	0.26	64.43	-54778
5/6/96	18	0.22	61.29	-18814
5/7/96	18	0.19	67.00	-10206
5/8/96	17	0.30	56.43	-11750
5/9/96	18	0.36	61.93	-20056
5/10/96	17	0.63	67.43	-12128
5/11/96	17	0.82	66.07	9569
5/12/96	19	0.61	67.86	25445
5/13/96	19	0.42	67.07	15552
5/14/96	19	0.45	61.43	-35500
5/15/96	20	0.25	64.96	-68440
5/16/96	20	0.56	65.31	-13997
5/17/96	21	0.50	64.45	30294
5/18/96	20	0.61	67.37	-6232
5/19/96	21	0.46	61.42	-7366
5/20/96	22	0.59	58.93	-18922
5/21/96	24	0.88	56.61	-52121
5/22/96	24	0.42	60.03	-106574
5/23/96	24	0.36	52.70	-103453
5/24/96	24	0.40	55.84	-106790
5/25/96	24	0.72	79.35714286	-49140
5/26/96	23	1.35	68	23404
5/27/96	24	0.51	71.92857143	17831
5/28/96	24	1.4	79.35714286	15358
5/29/96	24	2.15	71.57142857	2225
5/30/96	24	0.52	67.07142857	-3380
5/31/96	24	1.13	75.42857143	-15055
6/1/96	24	1.52	74.35714286	-48136
6/2/96	24	0.47	75.78571429	-3013
6/3/96	24	2.43	74.5	-599
6/4/96	24	1.34	74	1814
6/5/96	24	1.13	76.78571429	-26719
6/6/96	24	0.25	74.71428571	-67867
6/7/96	25	0.25	75.42857143	-56106
6/8/96	25	1.43	101.1428571	-25844
6/9/96	25	0.24	84.07142857	-35824
6/10/96	24	1.14	65.07142857	-53255
6/11/96	23	0.73	68.42857143	11189
6/12/96	21	1.46	61.07142857	48114
6/13/96	18	1.19	67.64285714	79499
6/14/96	14	0.4	137.1428571	91400
6/15/96	11	0.29	77.57142857	122623
6/16/96	8	0.29	72.21428571	133229
6/17/96	7	0.87	78	134492
6/18/96	5	0.17	78.78571429	130183
6/19/96	5	0.25	78.21428571	123455
6/20/96	4	0.2	76	122710
6/21/96	4	0.31	85.21428571	167108
6/22/96	4	0.54	76.92857143	256414
6/23/96	4	0.39	74.28571429	319831
6/24/96	3	0.16	73.5	362556
6/25/96	3	0.18	74	347285
6/26/96	2	0.55	76.07142857	327186
6/27/96	2	0.41	78.85714286	341701
6/28/96	2	0.68	77.78571429	341906
6/29/96	1	0.41	72.64285714	314226
6/30/96	1	0.34	72.42857143	250074
7/1/96	1	0.93	69.28571429	238918
7/2/96	1	0.28	70.42857143	207392
7/3/96	1	0.33	63.35714286	168253
7/4/96	1	0.41	76	86206
7/5/96	0	0.29	82.14285714	11275
7/6/96	0	0.38	90.71428571	30661
7/7/96	0	0.36	90	53989
7/8/96	0	0.28	95.71428571	125593
7/9/96	0	0.25	95.71428571	178114
7/10/96	0	0.23	95	222707
7/11/96	0	0.24	87.85714286	212717
7/12/96	0	0.25	91.42857143	170392
7/13/96	0	0.26	90	134222
7/14/96	0	0.23	93.57142857	122234
7/15/96	0	0.23	89.28571429	123120
7/16/96	0	0.25	85	148975
7/17/96	0	0.3	83.57142857	151286

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Date	Salinity	TP	TN	h20flx
7/18/96	0	0.29	78.57142857	162778
7/19/96	0	0.34	82.14285714	134390
7/20/96	0	0.36	83.57142857	106002
7/21/96	0	0.34	83.57142857	163361
7/22/96	0	0.36	84.28571429	142700
7/23/96	0	0.37	87.14285714	116111
7/24/96	0	0.38	87.14285714	104090
7/25/96	0	0.32	89.28571429	45004
7/26/96	1	0.3	80.71428571	52142
7/27/96	1	0.28	87.85714286	55836
7/28/96	1	0.28	80.71428571	53125
7/29/96	6	0.1	66.42857143	51948
7/30/96	6	0.11	66.42857143	53201
8/1/96	6	0.26	77.85714286	27454
8/2/96	6	0.19	71.42857143	13165
8/3/96	7	0.16	72.85714286	11977
8/4/96	9	0.17	69.28571429	-27713
8/5/96	6	0.24	60.80	-34895
8/6/96	2	0.22	80.71428571	-4892
8/7/96	2	0.3	84.28571429	18911
8/8/96	1	0.2	86.42857143	40738
8/9/96	1	0.19	87.85714286	31190
8/10/96	7	0.21	72.14285714	21924
8/11/96	7	0.16	71.42857143	9083
8/12/96	6	0.3	77.85714286	-2992
8/13/96	8	0.17	71.42857143	-18662
8/14/96	10	0.32	77.35	-6080
8/15/96	10	0.32	75.34875	4828
8/16/96	8	0.40	77.57375	-1112
8/17/96	8	0.41	78.11875	6793
8/18/96	7	0.37	82.8625	13954
8/19/96	6	0.42	89.055	27594
8/20/96	4	0.45	88.22125	58266
8/21/96	5	0.43	88.91625	50803
8/22/96	4	0.43	87.86	74574
8/23/96	3	0.42	78.145	62327
8/24/96	5	0.37	81.445	34009
8/25/96	3	0.28	65.12	66020
8/26/96	2	0.28	65.59	90072
8/27/96	1	0.49	118.5714286	86054
8/28/96	2	0.36	142.1428571	73224
8/29/96	4	0.28	65.00	60458
8/30/96	6	0.28	64.69	45932
8/31/96	9	0.24	125.7142857	50404
9/1/96	8	0.21	110.7142857	38923
9/2/96	7	0.19	109.2857143	33620
9/3/96	9	0.19	100	27356
9/4/96	7	0.19	103.5714286	39938
9/5/96	9	0.28	65.10	65297
9/6/96	11	0.29	109.2857143	99554
9/7/96	11	0.28	103.5714286	-44194
9/8/96	11	0.3	95.71428571	-50263
9/9/96	7	0.28	65.20	70092
9/10/96	2	0.45	101.4285714	53158
9/11/96	2	0.53	105.7142857	52942
9/12/96	12	0.59	100.7142857	71204
9/13/96	9	0.2	65.30785714	84402
9/14/96	10	0.17	59.3075	123185
9/15/96	9	0.2	63.07757143	159440
9/16/96	1	0.26	63.07721429	103669
9/17/96	2	0.37	64.88214286	99295
9/18/96	1	0.26	67.78985714	128574
9/19/96	2	0.45	71.88064286	119632
9/20/96	1	0.25	72.56364286	149731
9/21/96	1	0.29	80.58692857	138499
9/22/96	1	0.27	79.67942857	143986
9/23/96	1	0.29	77.19628571	143597
9/24/96	2	0.32	81.88907143	138596
9/25/96	1	0.34	84.18214286	138154
9/26/96	9	0.28	72.44457143	141167
9/27/96	1	0.44	75.29442857	133585
9/28/96	1	0.51	82.81614286	115268
9/29/96	1	0.37	77.48164286	133348
9/30/96	3	0.24	75.42378571	118238
10/1/96	1	0.35	73.93585714	119480
10/2/96	1	0.33	71.22764286	123811
10/3/96	1	0.36	74.51728571	138413
10/4/96	1	0.45	74.64128571	155250
10/5/96	0	0.205	74.66628571	157648
10/6/96	0	0.24	71.73578571	121900

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Date	Salinity	TP	TN	h20flx
10/6/96	0	0.24	71.73578571	121900
10/7/96	7	0.14	68.6545	129298
10/8/96	7	0.13	69.49285714	132678
10/9/96	8	0.225	70.84264286	-32486
10/10/96	5	0.21	69.376	-184680
10/11/96	4	0.24	73.85957143	157864
10/12/96	3	0.3	72.76971429	264265
10/13/96	2	0.24	67.6585	292259
10/14/96	1	0.225	61.98421429	301795
10/15/96	1	0.285	59.55957143	259589
10/16/96	0	0.3	62.37585714	329357
10/17/96	0	0.245	61.1195	292637
10/18/96	0	0.29	56.21714286	246370
10/19/96	0	0.325	59.05857143	265637
10/20/96	0	0.35	58.65007143	288166
10/21/96	0	0.33	67.66607143	287842
10/22/96	0	0.39	56.435	253098
10/23/96	0	0.35	57.10835714	262030
10/24/96	0	0.4	59.88607143	227286
10/25/96	0	0.57	57.14364286	215168
10/26/96	0	0.32	66.48	207986
10/27/96	1	0.32	66.47	210406
10/28/96	1	0.32	66.46	213916
10/29/96	1	0.33	66.35	229932
10/30/96	1	0.34	66.19	246866
10/31/96	1	0.33	66.43	219704
11/1/96	1	0.31	66.50	176980
11/2/96	1	0.29	66.36	148792
11/3/96	1	0.28	51.51892857	148878
11/4/96	2	0.11	51.67278571	161050
11/5/96	2	0.30	66.48	168998
11/6/96	2	0.09	59.16142857	183082
11/7/96	5	0.08	52.56857143	164657
11/8/96	5	0.08	56.63607143	132127
11/9/96	3	0.09	53.78242857	116662
11/10/96	1	0.16	52.2465	66150
11/11/96	3	0.26	59.9425	190080
11/12/96	2	0.28	70.09125	177174
11/13/96	2	0.29	60.585	168642
11/14/96	1	0.30	61.55375	141448
11/15/96	2	0.28	51.67666667	125852
11/16/96	1	0.28	62.77333333	142636
11/17/96	3	0.41	61.4125	132203
11/18/96	4	0.40	55.92875	127332
11/19/96	7	0.33	55.08625	116986
11/20/96	10	0.27	55.29375	63104
11/21/96	11	0.20	56.875	-45727
11/22/96	9	0.26	60.72907143	-92362
11/23/96	10	0.26	51.73642857	-105678
11/24/96	10	0.26	53.61664286	-83354
11/25/96	10	0.28	57.68957143	43999
11/26/96	8	0.28	35.812	78203
11/27/96	7	0.28	53.08792857	42563
11/28/96	4	0.28	60.26664286	79402
11/29/96	3	0.28	57.41892857	95569
11/30/96	4	0.28	61.64635714	86141
12/1/96	4	0.28	56.0555	62662
12/2/96	4	0.28	55.19964286	47153
12/3/96	7	0.28	42.40507143	41774
12/4/96	3	0.12	57.48	39334
12/5/96	5	0.15	54.76564286	48190
12/6/96	6	0.34	63.25571429	48038
12/7/96	7	0.18	57.89185714	36644
12/8/96	10	0.24	61.20071429	40705
12/9/96	4	0.17	62.38071429	31428
12/10/96	4	0.2	66.88707143	38858
12/11/96	12	0.23	62.15721429	28858
12/12/96	8	0.25	58.71764286	9353
12/13/96	14	0.28	54.98242857	7560
12/14/96	15	0.31	57.66171429	-4126
12/15/96	8	0.28	66.46964286	-22918
12/16/96	13	1.08	63.18614286	8953
12/17/96	12	0.09	56.01407143	28760
12/18/96	14	0.08	57.69985714	21524
12/19/96	8	0.37	59.77957143	-36558
12/20/96	4	0.19	60.721	-76518
12/21/96	7	0.26	60.32114286	16200
12/22/96	9	0.26	65.48192857	129449
12/23/96	13	0.84	64.62335714	35197

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Date	Salinity	TP	TN	h20flx
12/23/96	13	0.84	64.62335714	35197
12/24/96	14	0.11	53.56085714	17550
12/25/96	15	0.08	60.46678571	15919
12/26/96	14	0.11	55.98964286	-5767
12/27/96	14	0.45	55.6065	356
12/28/96	12	0.14	60.98192857	4612
12/29/96	13	0.19	53.00178571	7150
12/30/96	12	0.22	55.45571429	19364
12/31/96	13	0.13	58.57914286	15260
1/1/97	13	0.16	50.56321429	9072
1/2/97	15	0.11	56.10457143	3240
1/3/97	15	0.08	55.19714286	-10476
1/4/97	15	0.08	54.13442857	-7884
1/5/97	17	0.1	55.00157143	-13500
1/6/97	17	0.12	53.60607143	-25596
1/7/97	16	0.29	48.42235714	-16524
1/8/97	16	0.24	60.92	-30888
1/9/97	23	0.26	58.73	-82188
1/10/97	26	0.49	64.91	-41256
1/11/97	18	0.65	67.620625	31104
1/12/97	14	0.44	61.82833333	61128
1/13/97	12	0.66	62.34833333	99900
1/14/97	11	0.73	75.12166667	97200
1/15/97	10	0.73	65.82166667	65448
1/16/97	9	0.78	70.213	82296
1/17/97	9	0.44	48.61375	65772
1/18/97	10	0.47	44.9	88452
1/19/97	7	0.47	64.92	56700
1/20/97	9	0.30	64.36	19116
1/21/97	11	0.30	52.20712143	18252
1/22/97	14	0.31	52.696	14148
1/23/97	13	0.89	48.04585714	1080
1/24/97	13	0.10	47.60128571	-4212
1/25/97	13	0.30	52.66864286	18360
1/26/97	13	0.29	46.43692857	25380
1/27/97	.	0.28	64.42	31428
1/28/97	.	0.33	64.96	9396
1/29/97	.	0.30	64.36	19224
1/30/97	.	0.29	64.38	28188
1/31/97	.	0.33	64.83	10260
2/1/97	.	0.33	64.86	10044
2/2/97	.	0.33	69.84	2484
2/3/97	.	0.16	69.84	-108
2/4/97	.	0.16	59.83	-6480
2/5/97	.	0.20	60.86	-12204
2/6/97	.	0.24	60.76	-36180
2/7/97	.	0.25	59.97	-56592
2/8/97		0.24	60.75	-36612
2/9/97	.	0.31	64.56	13284
2/10/97	.	0.14	59.51	-5724
2/11/97	.	0.19	60.58	-9612
2/12/97	.	0.24	60.82	-34344
2/13/97	.	0.24	60.78	-35748
2/14/97	.	0.35	65.40	7344
2/15/97	.	0.28	64.60	41904
2/16/97	.	0.29	64.34	21492
2/17/97	.	0.34	65.18	8208
2/18/97	.	0.36	65.68	6480
2/19/97	.	0.22	61.08	-19224
2/20/97	.	0.20	60.83	-11880
2/21/97	.	0.22	61.06	-16848
2/22/97	.	0.33	64.97	9288
2/23/97	17	0.42	54.37871429	10152
2/24/97	17	0.29	51.61064286	2376
2/25/97	18	0.31	50.53042857	-42768
2/26/97	19	0.42	49.28335714	540
2/27/97	18	0.48	50.783	-12312
2/28/97	18	0.47	47.518	-5832
3/1/97	19	0.32	51.07192857	8208
3/2/97	20	0.39	50.93385714	11988
3/3/97	19	0.44	50.25713571	-16632
3/4/97	20	0.3	54.02971429	432
3/5/97	19	0.3	48.84764286	-15120
3/6/97	19	0.26	54.66407143	864
3/7/97	18	0.26	54.724	16632
3/8/97	19	0.27	56.40264286	-6048
3/9/97	18	0.48	49.37492857	13824
3/10/97	19	0.25	46.64614286	-18684
3/11/97	19	0.23	44.47221429	-65988
3/12/97	20	0.28	48.82242857	-112968

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Date	Salinity	TP	TN	h20flx
3/12/97	20	0.28	48.82242857	-112968
3/13/97	20	0.23	60.86	-32940
3/14/97	20	0.51	38.84028571	-14580
3/15/97	21	0.22	64.39	29052
3/16/97	20	0.3	64.39	29052
3/17/97	19	0.47	49.45428571	30348
3/18/97	18	0.52	51.00721429	4428
3/19/97	20	0.46	50.18335714	-42012
3/20/97	21	0.35	47.75464286	-75060
3/21/97	21	0.21	44.80178571	-117612
3/22/97	21	0.29	45.66514286	-72900
3/23/97	22	0.33	45.66464286	-64044
3/24/97	22	0.28	48.2635	-11448
3/25/97	22	0.3	50.43014286	35856
3/26/97	22	0.35	45.27842857	7992
3/27/97	21	0.36	46.77707143	-17496
3/28/97	22	0.44	48.00842857	-4104
3/29/97	22	0.27	48.44321429	3888
3/30/97	22	0.47	52.18785714	36504
3/31/97	21	0.7	54.20871429	13824
4/1/97	21	0.68	52.99857143	-6048
4/2/97	22	0.57	63.29435714	-21600
4/3/97	22	0.42	57.80928571	-35532
4/4/97	23	0.3	51.76064286	-33480
4/5/97	23	0.26	46.47835714	-41904
4/6/97	24	1.62	72.43721429	-37368
4/7/97	23	0.2	44.15814286	-58212
4/8/97	24	0.22	50.39856429	-40608
4/9/97	24	0.27	53.7105	-30348
4/10/97	24	0.21	45.74342857	-57024
4/11/97	24	0.28	44.53078571	-33048
4/12/97	24	0.52	47.55321429	-61560
4/13/97	25	0.29	48.39514286	-32400
4/14/97	26	0.38	46.901	10800
4/15/97	26	0.24	48.00614286	33264
4/16/97	27	0.51	53.39164286	19656
4/17/97	26	0.45	49.87971429	-37152
4/18/97	26	0.4	48.82414286	-54648
4/19/97	27	0.26	44.86292857	-64908
4/20/97	27	0.29	46.05057143	-72792
4/21/97	27	0.19	40.72121429	-75924
4/22/97	27	0.25	48.10507143	-107676
4/23/97	27	0.26	52.977	-57132
4/24/97	27	0.26	51.28335714	-38232
4/25/97	27	0.3	46.55828571	-53892
4/26/97	28	0.27	44.62257143	-127224
4/27/97	28	0.31	46.21171429	-73008
4/28/97	28	0.45	44.58764286	-36288
4/29/97	28	0.26	42.785	10692
4/30/97	28	0.43	47.75371429	-15012
5/1/97	28	0.45	45.84471429	-55404
5/2/97	29	0.77	38.49678571	-36072
5/3/97	29	0.5	46.45357143	24840
5/4/97	27	0.25	44.13728571	104220
5/5/97	29	0.18	45.58914286	50976
5/6/97	29	0.34	50.98157143	21816
5/7/97	29	0.24	47.31042857	19008
5/8/97	29	0.20	56.72	-10692
5/9/97	30	0.25	60.56	-42120
5/10/97	30	0.25	59.63	-64044
5/11/97	30	0.30	58.08	-59076
5/12/97	30	0.44	58.28	-81972
5/13/97	30	0.39	48.625	24516
5/14/97	30	0.28	64.59	41148
5/15/97	30	1.02	52.05666667	37044
5/16/97	30	0.49	56.445	27648
5/17/97	30	0.29	64.34	21816
5/18/97	30	0.86	56.9825	29808
5/19/97	31	0.47	54.155	19548
5/20/97	31	0.23	50.705	-2052
5/21/97	30	0.74	59.825	-27216
5/22/97	25	0.23	51.984	-26676
5/23/97	25	0.2	53.54592857	21168
5/24/97	24	0.18	48.43964286	324
5/25/97	25	0.37	52.68371429	-3672
5/26/97	25	0.21	50.85828571	-18576
5/27/97	25	0.31	54.81771429	45144
5/28/97	25	0.22	51.23157143	37422
5/29/97	24	0.21	53.77657143	33561
5/30/97	24	0.52	58.158	29700

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Date	Salinity	TP	TN	h20flx
5/31/97	24	0.57	66.04114286	-20736
6/1/97	25	0.23	55.89535714	-107204
6/2/97	25	0.15	52.72742857	-183714
6/3/97	25	0.15	54.46635714	-121063
6/4/97	25	0.16	57.22778571	-27368
6/5/97	25	0.28	58.16671429	-37034
6/6/97	25	0.25	53.47964286	-56687
6/7/97	25	0.26	54.43307143	-66155
6/8/97	25	0.22	51.30878571	29155
6/9/97	23	0.33	55.74514286	226976
6/10/97	11	0.38	39.66414286	356848
6/11/97	8	0.4	41.59264286	421785
6/12/97	4	0.43	43.782	486721
6/13/97	4	0.42	39.37585714	457191
6/14/97	4	0.37	41.55307143	444684
6/15/97	2	0.33	45.22442857	457185
6/16/97	2	0.4	46.08357143	434825
6/17/97	1	0.46	49.77242857	412200
6/18/97	1	0.58	51.85271429	387369
6/19/97	1	0.42	53.04442857	369461
6/20/97	0	0.47	58.12528571	350445
6/21/97	0	0.46	52.88478571	334220
6/22/97	0	0.42	56.70442857	329377
6/23/97	0	0.43	56.12121429	327519
6/24/97	0	0.4	55.1255	317046
6/25/97	0	0.42	56.94857143	326689
6/26/97	0	0.42	57.33971429	314722
6/27/97	0	0.38	55.63385714	298079
6/28/97	0	0.43	55.78721429	281436
6/29/97	0	0.45	61.09378571	263326
6/30/97	0	0.47	60.23528571	251682
7/1/97	0	0.5	62.18192857	242680
7/2/97	0	0.43	61.77057143	231119
7/3/97	0	0.46	62.61935714	209741
7/4/97	0	0.31	64.89814286	183089
7/5/97	0	0.24	66.52	184187
7/6/97	0	0.26	63.357	210304
7/7/97	0	0.26	61.59528571	211135
7/8/97	0	0.25	61.84242857	214311
7/9/97	0	0.27	63.27664286	210824
7/10/97	0	0.22	65.43771429	195676
7/11/97	0	0.25	59.623	192041
7/12/97	0	0.32	61.41928571	178016
7/13/97	0	0.32	65.95957143	166971
7/14/97	0	0.35	66.66621429	136758
7/15/97	0	0.38	69.57907143	148881
7/16/97	0	0.42	73.08221429	180103
7/17/97	0	0.37	68.633	198384
7/18/97	0	0.37	72.46114286	194713
7/19/97	0	0.34	71.09435714	191043
7/20/97	0	0.31	60.92664286	188458
7/21/97	0	0.21	52.73742857	189690
7/22/97	0	0.29	67.97657143	201597
7/23/97	0	0.29	67.265	172538
7/24/97	0	0.31	66.35971429	190699
7/25/97	0	0.3	66.45	214923
7/26/97	0	0.27	66.41	221696
7/27/97	0	0.34	66.43	218782
7/28/97	0	0.62	66.49	207235
7/29/97	0	0.33	66.52	190108
7/30/97	0	0.36	66.49	171397
7/31/97	0	0.42	66.41	155550
8/1/97	0	0.36	66.35	146849
8/2/97	1	0.44	66.57	118709
8/3/97	2	0.44	67.3575	95914
8/4/97	4	0.42	71.375	121724
8/5/97	2	0.36	66.285	81463
8/6/97	5	0.24	62.605	41201
8/7/97	5	0.26	72.25	103892
8/8/97	3	0.49	68.5	126446
8/9/97	3	0.53	65.965	142418
8/10/97	4	0.57	65.94	150168
8/11/97	4	0.54	63.445	144338
8/12/97	2	0.30	66.41	156028
8/13/97	1	0.30	66.42	156812
8/14/97	0	0.27	58.01114286	118912
8/15/97	1	0.25	58.27771429	59578
8/16/97	1	0.27	59.80114286	61076
8/17/97	2	0.24	59.92728571	62946
8/18/97	0	0.26	61.58957143	97966

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Date	Salinity	TP	TN	h20flx
8/19/97	0	0.22	59.46478571	95820
8/20/97	1	0.23	59.63942857	17265
8/21/97	2	0.18	55.61407143	-43205
8/22/97	4	0.2	56.467	-135723
8/23/97	4	0.21	56.531	-85565
8/24/97	4	0.25	57.26964286	38992
8/25/97	4	0.31	60.21321429	101260
8/26/97	3	0.33	65.75835714	152656
8/27/97	2	0.31	64.99142857	145874
8/28/97	1	0.34	63.338	118256
8/29/97	2	0.29	57.6385	110621
8/30/97	1	0.35	57.14228571	70970
8/31/97	3	0.33	58.01378571	95546
9/1/97	1	0.67	55.69014286	93097
9/2/97	3	0.29	64.36	26436
9/3/97	1	0.22	66.34	146277
9/4/97	2	0.22	65.45	82765
9/5/97	4	0.28	65.83	104271
9/6/97	0	0.32	66.46	213186
9/7/97	0	0.35	65.97	263967
9/8/97	0	0.36	65.88	269806
9/9/97	0	0.32	66.48	207615
9/10/97	0	0.31	66.50	177124
9/11/97	1	0.29	66.37	149652
9/12/97	0	0.30	66.42	156769
9/13/97	0	0.31	66.52	187155
9/14/97	0	0.30	66.46	164162
9/15/97	0	0.25	66.25	136733
9/16/97	4	0.23	65.94	111155
9/17/97	5	0.27	66.03	117350
9/18/97	8	0.25	66.16	127846
9/19/97	3	0.27	66.51	180866
9/20/97	1	0.38	66.51	181967
9/21/97	3	0.36	54.77240885	175270
9/22/97	0	0.38	53.81987274	186702
9/23/97	0	0.3	57.60478875	185718
9/24/97	2	0.4	66.37618287	179051
9/25/97	0	0.38	45.19379809	161872
9/26/97	3	0.32	47.59897038	-34379
9/27/97	6	0.34	48.97219753	-204503
9/28/97	6	0.26	49.77029096	-223579
9/29/97	5	0.25	52.71643153	203763
9/30/97	2	0.36	52.81557646	257078
10/1/97	0	0.35	51.75626172	246793
10/2/97	0	0.34	66.1629049	256624
10/3/97	0	0.36	55.39567207	249646
10/4/97	0	0.3	52.68403487	252003
10/5/97	0	0.23	53.83998101	267591
10/6/97	0	0.34	52.89787141	257619
10/7/97	0	0.25	38.06551013	245012
10/8/97	0	0.27	51.06485382	229992
10/9/97	0	0.3	52.96657466	214978
10/10/97	0	0.33	57.7620948	203760
10/11/97	0	0.27	62.55426306	188562
10/12/97	0	0.5	52.64985508	166595
10/13/97	0	0.29	56.30568151	162313
10/14/97	0	0.27	58.64198991	168725
10/15/97	0	0.28	57.15738139	136368
10/16/97	2	0.27	53.18635714	50456
10/17/97	7	0.27	49.55714286	-58179
10/18/97	8	0.3	46.02978571	-34413
10/19/97	11	0.18	48.86785714	30246
10/20/97	7	0.35	49.6475	119085
10/21/97	8	0.29	45.9905	114712
10/22/97	11	0.36	60.79171429	43772
10/23/97	12	0.33	47.50657143	41337
10/24/97	12	0.67	47.91685714	-4859
10/25/97	10	0.35	43.94021429	-13484
10/26/97	11	0.41	44.2475	-12332
10/27/97	10	0.48	44.95435714	22567
10/28/97	9	0.29	52.0725	170250
10/29/97	2	0.22	55.64985714	146252
10/30/97	5	0.33	51.22042857	130449
10/31/97	6	0.21	45.05342857	109211
11/1/97	9	0.33	44.96942857	-3050
11/2/97	8	0.2	39.90807143	-92741
11/3/97	8	0.44	50.94014286	155804
11/4/97	1	0.24	42.28642857	165785
11/5/97	1	0.38	55.10	154583
11/6/97	1	0.35	57.09	110077

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Date	Salinity	TP	TN	h20flx
11/7/97	2	0.32	49.84	67733
11/8/97	8	0.29	50.01	47772
11/9/97	10	0.30	56.51	34431
11/10/97	12	0.32	51.22	-5809
11/11/97	12	0.33	50.23	9535
11/12/97	13	0.26	46.82	-38094
11/13/97	14	0.24	45.18	-143327
11/14/97	14	0.32	46.12	-155996
11/15/97	14	0.39	52.17	81117
11/16/97	9	0.35	50.50	172202
11/17/97	5	0.32	57.27	190419
11/18/97	5	0.29	32.26	128297
11/19/97	3	0.30	58.22	102160
11/20/97	5	0.32	60.07	63904
11/21/97	5	0.33	44.03	56319
11/22/97	6	0.26	41.36	34538
11/23/97	9	0.24	54.80	55239
11/24/97	3	0.32	49.24	54908
11/25/97	6	0.39	56.75	60880
11/26/97	4	0.38	60.25	33453
11/27/97	4	0.28	58.73	43000
11/28/97	10	0.30	64.38	18303
11/29/97	11	0.2	64.82	52175
11/30/97	7	0.25	65.23	71491
12/1/97	10	0.25	64.88	55074
12/2/97	12	0.3	65.20	69944
12/3/97	10	0.29	65.13	66941
12/4/97	7	0.24	65.94	111620
12/5/97	2	0.29	66.41	156298
12/6/97	2	0.26	66.50	200977
12/7/97	2	0.23	66.20	245656
12/8/97	1	0.23	66.39	225254
12/9/97	.	0.3	66.50	203672
12/10/97	.	0.28	66.51	178565
12/11/97	.	0.25	54.61	157987
12/12/97	.	0.285	53.42	142679
12/13/97	.	0.26	52.41	134014
12/14/97	.	0.18	54.08	174733
12/15/97	.	0.28	52.27	181311
12/16/97	.	0.43	49.12	199232
12/17/97	.	0.32	53.91	173122
12/18/97	.	0.32	46.66	153540
12/19/97	.	0.29	51.20	160614
12/20/97	.	0.29	66.43	159731
12/21/97	.	0.28	50.84	170611
12/22/97	.	0.24	54.92	140514
12/23/97	.	0.21	53.26	147549
12/24/97	.	0.31	51.70	153860
12/25/97	.	0.32	51.86	141576
12/26/97	.	0.18	54.28	132593
12/27/97	.	0.14	59.53	140409
12/28/97	.	0.21	57.90	141283
12/29/97	.	0.29	66.34	145892
12/30/97		0.28	65.97	113074
12/31/97	.	0.115	66.37	149871
1/1/98	0.6	0.41	53.26228571	199967
1/2/98	1.0	0.14	51.69785714	150088
1/3/98	0.5	0.37	51.86185714	170871
1/4/98	0.6	0.23	54.28371429	152999
1/5/98	0.5	0.27	59.53028571	152289
1/6/98	0.6	0.3	57.90207143	122474
1/7/98	0.7	0.329919108	53.20	98753
1/8/98	0.6	0.375172062	63.33	104785
1/9/98	2.1	0.432420933	63.68	124592
1/10/98	1.0	0.441947368	62.95	146366
1/11/98	0.8	0.426599396	58.07	129052
1/12/98	0.9	0.427869496	59.99	108999
1/13/98	1.0	0.364256088	59.03	90094
1/14/98	1.2	0.381374747	60.23	92262
1/15/98	0.9	0.390961316	46.94	96149
1/16/98	0.8	0.353979549	63.12	113289
1/17/98	2.9	0.507693837	67.17	101896
1/18/98	2.1	0.17	51.39100946	105095
1/19/98	1.8	0.16	66.61392612	99039
1/20/98	1.5	0.15	53.6607524	89263
1/21/98	0.8	0.32	54.63074414	80431
1/22/98	4.2	0.15	47.89132453	48568
1/23/98	2.2	0.28	47.14700733	95596
1/24/98	1.4	0.45	46.62501048	108899
1/25/98	0.8	0.2	53.7647325	116927

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Date	Salinity	TP	TN	h20flx
1/26/98	0.9	0.14	52.41173342	89645
1/27/98	1.7	0.13	53.81431172	87443
1/28/98	2.4	0.14	50.78714924	93193
1/29/98	2.0	0.46	51.29929314	86788
1/30/98	3.5	0.28	109.3404167	79606
1/31/98	4.7	0.17	46.08068725	74010
2/1/98	6.2	0.18	43.52038703	44104
2/2/98	10.3	0.43	43.87739933	-130143
2/3/98	10.7	0.18	45.3826999	-34185
2/4/98	10.4	0.15	40.57728911	-33940
2/5/98	11.8	0.16	39.21076843	44838
2/6/98	6.5	0.18	45.31561596	325824
2/7/98	3.8	0.18	39.77102409	315858
2/8/98	2.6	0.12	57.84825728	301476
2/9/98	1.9	0.14	45.386683	298646
2/10/98	1.4	0.09	46.69247273	254842
2/11/98	1.2	0.12	30.78195298	207950
2/12/98	1.1	0.12	44.0641894	216870
2/13/98	1.0	0.18	46.95392651	204058
2/14/98	0.8	0.14	46.23598597	209267
2/15/98	2.9	0.16	45.63022063	137531
2/16/98	2.1	0.13	43.29934098	167545
2/17/98	0.9	0.17	44.68062436	169576
2/18/98	0.8	0.15	42.16422787	190710
2/19/98	1.0	0.4	46.14197796	203789
2/20/98	1.0	0.26	51.22629271	198335
2/21/98	1.0	0.21	55.66360549	171474
2/22/98	1.1	0.19	50.40578924	135394
2/23/98	1.0	0.2025	52.82961956	202714
2/24/98	1.0	0.215	51.36893882	122929
2/25/98	1.0	0.38	54.11213685	118791
2/26/98	1.1	0.25	55.93774747	100388
2/27/98	1.0	0.22	52.60651874	99013
2/28/98	1.4	0.12	49.39025278	96262
3/1/98	1.5	0.25	51.16467806	94887
3/2/98	1.0	0.13	50.51618618	119640
3/3/98	1.0	0.15	50.3137998	132017
3/4/98	1.0	0.17	52.32930084	121015
3/5/98	1.1	0.16	50.14529669	110014
3/6/98	1.0	0.15	49.83876136	105889
3/7/98	1.4	0.12	50.91927677	101763
3/8/98	2.4	0.123	51.93029239	97637
3/9/98	4.3	0.09	45.76209705	96262
3/10/98	1.0	0.12	48.81022393	118265
3/11/98	1.0	0.15	51.85835081	129267
3/12/98	0.9	0.15	51.84006732	118265
3/13/98	0.7	0.1	54.34748964	108639
3/14/98	1.0	0.08	52.10368749	103138
3/15/98	1.0	0.2	52.44203151	100388
3/16/98	1.1	0.085	57.27433594	97637
3/17/98	1.2	0.08	32.25515344	94887
3/18/98	1.7	0.14	58.22258592	92137
3/19/98	1.0	0.16	60.07150643	89386
3/20/98	1.1	0.15	44.03161894	94887
3/21/98	1.0	0.13	41.35720319	147144
3/22/98	2.3	0.1	54.80215252	148519
3/23/98	1.0	0.24	49.24324105	133392
3/24/98	1.0	1.009	56.75244601	130642
3/25/98	1.1	0.09	60.24995254	119640
3/26/98	1.0	0.13	58.73380989	111389
3/27/98	1.1	0.19	49.31070494	97256
3/28/98	1.1	0.1	47.32140949	81450
3/29/98	1.1	0.11	50.11715069	90770
3/30/98	1.1	0.6	48.41304676	70158
3/31/98	3.2	0.375	46.76154733	60612
4/1/98	0.6	0.15	47.00794304	90077
4/2/98	0.1	0.15	50.64704707	79741
4/3/98	0.1	0.1015	33.34514586	83479
4/4/98	1.3	0.1409	32.4049344	89961
4/5/98	0.3	0.1746	48.65061243	39220
4/6/98	0.3	0.1575	46.70668836	-10893
4/7/98	0.5	0.1313	51.8083853	-21655
4/8/98	0.5	0.0934	52.84694839	24863
4/9/98	0.5	0.0865	45.0351294	31540
4/10/98	0.3	0.0573	47.50817081	103158
4/11/98	0.1	0.0918	51.36926732	92088
4/12/98	0.2	0.0958	59.68885367	53971
4/13/98	0.2	0.0809	53.85631945	32414
4/14/98	5.5	0.0928	43.88893313	27896

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Date	Salinity	TP	TN	h20flx
4/15/98	4.8	0.1089	47.11815604	20439
4/16/98	7.6	0.076	45.58909942	-14430
4/17/98	8.4	0.1089	45.00800226	3111
4/18/98	8.4	0.0521	42.96134387	4663
4/19/98	8.7	0.0783	45.20017769	38236
4/20/98	5.2	0.1266	48.91431068	51398
4/21/98	5.7	0.13895	47.62597017	24798
4/22/98	6.7	0.1513	46.33762967	22934
4/23/98	8.1	0.1273	42.47047178	5657
4/24/98	8.2	0.0879	43.51620819	-8284
4/25/98	8.7	0.1195	42.309895	-34596
4/26/98	8.9	0.0977	43.01927473	-7539
4/27/98	9.1	0.1047	46.3301057	-11271
4/28/98	9.6	0.1766	43.93938103	-12295
4/29/98	9.8	0.1531	46.62024373	17286
4/30/98	10.0	0.155	48.01816226	-53472
5/1/98	11.4	0.20	47.01	-46865
5/2/98	12.0	0.27	50.65	-43562
5/3/98	12.7	0.19	33.35	-40259
5/4/98	14.1	0.19	32.40	-33653
5/5/98	14.7	0.24	48.65	-30350
5/6/98	15.4	0.17	46.71	-27047
5/7/98	15.5	0.20	51.81	-36519
5/8/98	15.4	0.27	52.85	-39863
5/9/98	15.2	0.19	45.04	-49801
5/10/98	14.7	0.19	47.51	-45978
5/11/98	15.3	0.24	51.37	-58737
5/12/98	15.9	0.17	59.69	-49513
5/13/98	16.1	0.2	53.86	-9533
5/14/98	16.0	0.37	43.89	13352
5/15/98	15.8	0.35	47.12	46174
5/16/98	15.5	0.37	45.59	51975
5/17/98	15.5	0.47	45.01	13472
5/18/98	15.9	0.36	42.96	-25032
5/19/98	16.3	0.30	45.20	331
5/20/98	16.4	0.25	48.91	-29546
5/21/98	16.1	0.37	47.63	17530
5/22/98	16.6	0.28	46.34	5795
5/23/98	17.6	0.39	42.47	-43696
5/24/98	18.5	0.41	43.52	-31036
5/25/98	18.7	0.41	42.31	-48699
5/26/98	18.7	0.23	43.02	-82589
5/27/98	18.6	0.28	46.33	-58478
5/28/98	18.5	0.27	43.94	-30302
5/29/98	18.6	0.17	46.62	-29125
5/30/98	18.5	0.13	48.02	-36577
5/31/98	18.4	0.50	48.02	-23486

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VITA

Martha Sutula was born to Dr. Chester Sutula and Gloria Sutula on July 31, 1964, in Engelwood, Colorado. She grew up in Indiana and New Jersey, and graduated from Clay High School in South Bend, Indiana, in 1982. Martha went on to study chemistry at Purdue University in West Lafayette, Indiana, from which she graduated in 1987 with a bachelor of science degree. She joined the Peace Corps in 1987, and served until 1991 as a fisheries volunteer in Zaire, Central Africa. Upon returning to the United States, she worked for two years as a project manager in the U.S. Environmental Protection Agency (US EPA) in the Office of Pollution Prevention and Toxics. Martha left the US EPA in 1993 to study evaluation of community development programs at the Tulane University School of Public Health and Tropical Medicine in New Orleans, Louisiana. She obtained a master's in public health with a specialization in Biostatistics from Tulane in 1994. From there, Martha went on to study estuarine ecology under the tutelage of Dr. John Day, of the Department of Oceanography and Coastal Sciences at the Louisiana State University, Baton Rouge, Louisiana. She will receive the degree of Doctor of Philosophy in May 1999, with a dissertation entitled "Processes controlling nutrient transport in the Southeastern Everglades Wetlands, Florida, USA." Martha is pursuing her research interests in aquatic organic nutrient cycling in the Southern Everglades, Mississippi River, and Gulf of Mexico in her post-doctoral position at the Tulane University Department of Ecology, Evolution, & Organismal Biology with Dr. Thomas Bianchi.

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Florida Bay. The low P flux relative to other estuarine systems reflects the efficiency of Everglades ecosystem in conserving P. Atmospheric deposition was the dominant P source to the watershed. Surface water was the major N source during the wet season, but annually equaled atmospheric N deposition. Annually 20 mg P m^{-2} and 590 mg N m^{-2} were imported into the watershed from hydrologic sources (surface water, groundwater, atmospheric deposition). Annual P import roughly equaled sediment P burial (33-71 mg m^{-2}), while sediment N burial (1890-4071 mg m^{-2}) exceeded hydrologic import. This budget deficit may be balanced by N fixation or may be due to underestimation of groundwater flux into the watershed. Further research is needed on the contribution of groundwater and N fixation to the nutrient budget of the SE Everglades wetlands.

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DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Martha Sutula

Major Field: Oceanography and Coastal Sciences

Title of Dissertation: Processes Controlling Nutrient Transport in the Southeastern Everglades Wetlands, Florida, USA

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Robert P. Gambrell

Joseph Suhayda

Date of Examination:

3/19/99

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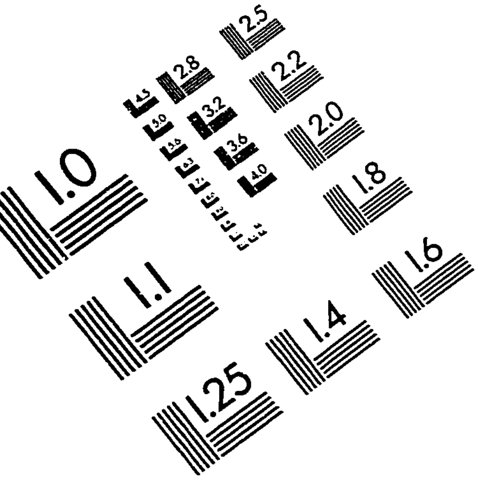
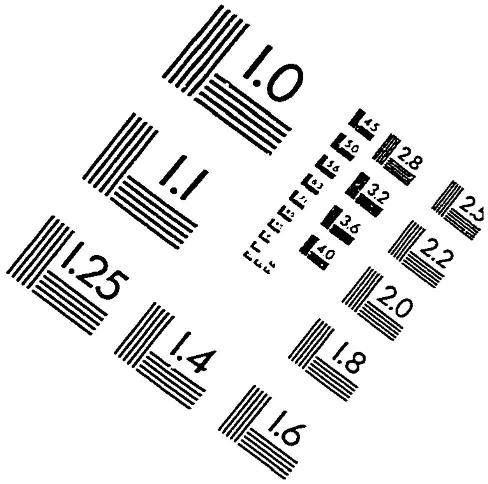
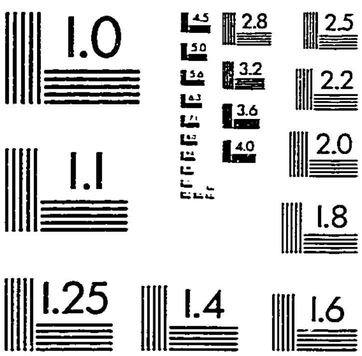
IMAGE EVALUATION TEST TARGET (QA-3)







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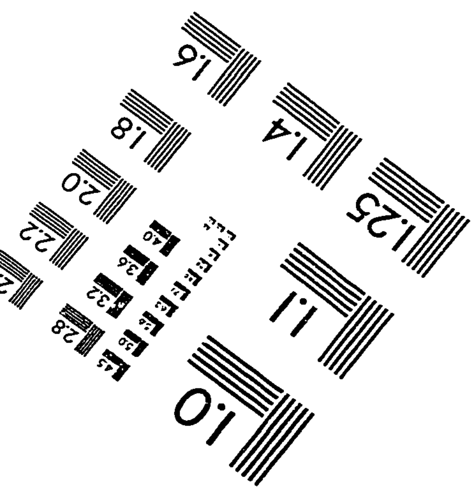

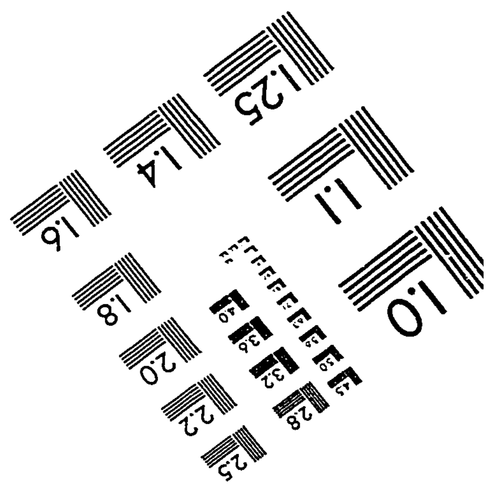

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